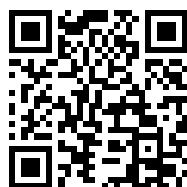

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NORTH SEA PILOT

PART IV

FIFTH EDITION

1892

(To be pasted on inside of cover of all Sailing Directions.)

NOTATIONS OF SUPPLEMENTS OR HYDROGRAPHIC NOTICES RELATING TO THIS BOOK.

To be filled in by Navigating Officer.

[In Chart Dépôts the two first columns are alone to be filled up.]

Whether Supplement or Hyd. Notice.	Date of Publication and Number.	Whether pasted in or noted in Margins of book, and date of such correction.

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NORTH SEA PILOT.

PART IV.

THE SHORES OF THE NORTH SEA FROM
CAPE GRIS NEZ TO THE SKAW.

FIFTH EDITION.

COMPILED FROM VARIOUS AUTHORITIES.

PUBLISHED BY ORDER OF THE LORDS COMMISSIONERS OF THE ADMIRALTY.

LONDON :
PRINTED FOR THE HYDROGRAPHIC OFFICE, ADMIRALTY
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1892.

Price Three Shillings and Sixpence.



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ADVERTISEMENT TO FIFTH EDITION.

THE North Sea Pilot, Part IV., contains Sailing directions for the coast of France, Belgium, Holland, Germany, and Denmark, from cape Gris Nez to the Skaw or Skagen. Those for the rivers Thames and Medway on the East coast of England, given in previous editions of this work, are now given in North Sea Pilot, Part III., fifth edition, 1889.

The directions for the coast of France are from the *Pilote Français* of Beauteemps-Beaupré and Givry ; those from Dunkerque to the Elbe were originally compiled by Staff Captain E. K. Calver, R.N., from the charts of Ryk and Van Rhyn, the Dutch *Ariel* by Modera, and other authorities, as well as from his own observations ; whilst from the Elbe to the Skaw the directions were taken chiefly from the Danish Pilot by the late Admiral Zahrtmann, 1853.

The original work was prepared by Staff Commander J. Penn, of the Hydrographic Office, in 1863 ; and was revised by Captain E. J. Bedford, R.N., in 1871 ; the second edition was revised by Captain G. H. Inskip, R.N., in 1878 ; who also revised the third edition in 1887.

The present edition has been prepared by Staff Commander W. H. Petley, R.N., of the Hydrographic Department, from the latest surveys, Sailing directions, official notices of the several Governments ; and also from information furnished by local authorities.

By the publication of this work, all Supplements and Hydrographic Notices relating to the fourth edition, as also all Notices to Mariners, inclusive of No. 373 of 1892, are cancelled.

W. J. L. W.

Hydrographic Office, Admiralty, London,
September 1892.

**IN THIS WORK THE BEARINGS ARE ALL MAGNETIC,
EXCEPT WHERE MARKED AS TRUE.**

THE BEARINGS OF LIGHTS ARE GIVEN FROM SEAWARD,

**THE DISTANCES ARE EXPRESSED IN SEA MILES OF
60 TO A DEGREE OF LATITUDE.**

**A CABLE'S LENGTH IS ASSUMED TO BE EQUAL TO
100 FATHOMS.**

**THE SOUNDINGS ARE REDUCED TO LOW WATER OF
ORDINARY SPRING TIDES.**

CONTENTS.

CHAPTER I.

	Pages.
North sea ; general description and navigation ; winds and weather, with signals ; ice ; currents ; tides and tidal streams ; wrecks ; buoyage ; tidal signals ; routes - - - - -	1-35

CHAPTER II.

Cape Gris Nez to Dunkerque ; the outer banks ; Dunkerque or Flemish banks ; Calais ; Gravelines ; Dunkerque - - - - -	36-76
---	-------

CHAPTER III.

Dunkerque to the Schelde : Nieuport ; Ostende ; Blankenberghe ; Schelde river ; Flushing ; Terneuse ; Antwerp - - - - -	77-109
---	--------

CHAPTER IV.

East Schelde ; Brouwershaven ; Dordrecht ; Hellevoetsluis ; Voorne canal ; Goeree - - - - -	110-132
---	---------

CHAPTER V.

Goeree to the Texel ; Brielle ; New Rotterdam canal ; Rotterdam ; Ymuiden ; Amsterdam ; the Texel ; Zuider Zee - - - - -	133-159
SO 11363	b

CHAPTER VI.

	Pages.
Texel to the Elbe ; Harlingen ; Ems river ; Delfzijl ; Emden ; Jade river ; Wilhelmshaven ; Weser river ; Bremerhaven ; Heligoland ; Elbe river ; Cuxhaven ; Hamburg - - - - -	160-210

CHAPTER VII.

Elbe river to Horn reefs ; Eider river ; Tonning ; Hever river ; Sylt island ; Lister deep ; Graa deep ; Horn reefs - - - - -	211-239
--	---------

CHAPTER VIII.

Horn reefs to the Skaw ; Liim Fiord ; Hanstholm ; Hirtshals point ; the Skaw or Skagen - - - - -	240-261
Index - - - - -	262-276
List of Admiralty Sailing Directions - - - - -	277-282
Agents for the sale of Admiralty charts - - - - -	283, 284

INFORMATION RELATING TO CHARTS, SAILING DIRECTIONS, AND THE GENERAL NAVIGATION OF H.M. SHIPS.

ON THE CORRECTION OF CHARTS, LIGHT LISTS, AND SAILING DIRECTIONS.

There are three descriptions of publications as guides to navigation—the charts, the sailing directions, and the light lists—which are all affected by the continual changes and alterations that take place.

Of these the charts should always be, so far as our knowledge permits, absolutely correct to date ; and the light lists should be noted for the recent alterations, though space will not permit of full details being always inserted. The sailing directions, however, cannot, from their nature, be so corrected, and *in all cases where they differ from charts, the charts must be taken as the guide.*

Charts.—When issued to a ship on commissioning, the charts have received all necessary corrections to date. As sent from the Hydrographic Office they are, as a rule, fresh from the plates. They then receive such corrections by hand in the dépôts as are required, and are so issued to the ships.

All small but important corrections that can be made by hand are notified by Notices to Mariners, and should at once be placed on the charts to which they refer.

Large corrections that cannot be conveniently thus made are put upon the plates, and fresh copies are issued to the ships to replace the others, which are directed to be destroyed to prevent the possibility of their being used in the navigation of the ship.

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The dates on which these large corrections are made are noted on the chart plates in the middle of the lower edge; those of the smaller corrections at the left-hand lower corners.

In all cases of quotations of charts, these dates of corrections should be given, as well as the number of the chart, in order that at the Admiralty it may be known what edition of the chart is referred to.

The Light Lists, annually published at the beginning of each year, are not corrected in the depôts before issue, but appendices are issued every two months, giving the alterations that have taken place, copies of which are put into the chart boxes.

It is the duty of the navigating officer when he receives the set of charts to make notations in the light lists from these appendices, and from the Notices to Mariners in the box; and to keep them so corrected from time to time.

The Light Lists should always be consulted as to the details of a light, as the description in the Sailing Directions may be obsolete, in consequence of changes made since publication.

The Sailing Directions are not corrected before issue, except occasionally for very important new rocks or dangers. Hydrographic Notices and Supplements referring to each volume are published from time to time.

Supplements contain all the information received up to date since the publication of the volume to which they refer, and cancel all previous Hydrographic Notices.

Hydrographic Notices contain all information up to date since the publication of the volume, or since the last Supplement or Hydrographic Notice, but endeavour is made to issue no more than one of these affecting each volume, and, on the collection of fresh information, to include the former Notice in a Supplement.

The existence of Supplements or Hydrographic Notices is to be noted, in the tabulated form now being placed for the purpose inside the cover of each volume, in cases when such notations have not been made before issue, and also on receipt of further Notices after commission.

Notes should be made in the margin of the volume of sailing directions affected, as references to the Supplements or Hydrographic Notices when the latter are printed on both sides.

To enable the books to be more conveniently corrected, however, such Supplements and Hydrographic Notices as are of moderate size are now being printed on one side only, and two copies are issued to each ship ; one to cut up, the slips being pasted in at the appropriate place ; the other to retain intact for reference.

To make these notations or paste in these slips is one of the early duties of a navigating officer after drawing his box of charts and books, and similar notes are to be made from Notices to Mariners that may thereafter be received.

It must, however, be thoroughly understood that sailing directions will never be correct in all details, except up to the date of the last Hydrographic Notice or Supplement, and that, as already stated, when differences exist, the chart, which should be corrected from the most recent information, should be taken as the guide ; for which purpose, for ordinary navigation, they are sufficient.

THE USE OF CHARTS AS NAVIGATIONAL AIDS.

Accuracy of a Chart.—The value of a chart must manifestly depend upon the accuracy of the survey on which it is based, and this becomes more important the larger is the scale of the chart.

To estimate this, the date of the survey, which is always given in the title, is a good guide. Besides the changes that, in waters where sand or mud prevails, may have taken place since the date of the survey, the earlier surveys were mostly made under circumstances that precluded great accuracy of detail, and until a plan founded on such a survey is tested, it should be regarded with caution. It may, indeed, be said that, except in well-frequented harbours and their approaches, no surveys yet made have been so minute in their examination of the bottom as to make it certain that all dangers have been found. The fullness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed, it may be taken for granted that the survey was not in great detail.

Blank spaces among soundings mean that no soundings have been obtained in these spots. When the surrounding soundings are deep it may with fairness be assumed that in the blanks the water is also deep; but when they are shallow, or it can be seen from the rest of the chart that reefs or banks are present, such blanks should be regarded with suspicion. This is especially the case in coral regions and off rocky coasts, and it should be remembered that in waters where rocks abound it is always possible that a survey, however complete and detailed, may have failed to find every small patch.

A wide berth should therefore be given to every rocky shore or patch, and this rule should be invariably followed, viz., that instead of considering a coast to be clear unless it is shown to be foul, the contrary should be assumed.

Fathom Lines a Caution.—Except in plans of harbours that have been surveyed in detail, the five-fathom line on most Admiralty charts is to be considered as a caution or danger line against unnecessarily approaching the shore or bank within that line, on account of the possibility of the existence of undiscovered inequalities of the bottom, which nothing but an elaborate detailed survey could reveal. In general surveys of coasts or of little frequented anchorages, the necessities of navigation do not demand the great expenditure of time required for such a detailed survey. It is not contemplated that ships will unnecessarily approach the shores in such localities without taking special precautions.

The ten-fathom line is, on rocky shores, another warning, especially for ships of heavy draught.

Charts where no fathom lines are marked must be especially regarded with caution, as it generally means that soundings were too scanty and the bottom too uneven to enable them to be drawn with accuracy.

Isolated soundings shoaler than surrounding depths should always be avoided, especially if ringed round, as there is no knowing how closely the spot may have been examined.

Chart on largest scale always to be used.—It sometimes happens that, from press of work, only the copper plate of the larger scale chart of a particular locality can at once receive any extensive

re-arrangement of coastline or soundings. This is an additional reason, besides the obvious one of the greater detail shown on a larger scale chart, why this largest scale chart should always be used for navigating.

Caution in using small Scale Charts.—In approaching the land or dangerous banks, regard must always be had to the scale of the chart used. A small error in laying down a position means only yards on a large scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile. This is particularly to be observed when coming to an anchor on a narrow ledge of convenient depth at some distance from the shore.

For the same reason bearings to objects near should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

Distortion of Printed Charts.—The paper on which charts are printed has to be damped. On drying distortion takes place, from the inequalities in the paper, which greatly varies with different paper and the amount of the original damping; but it does not affect navigation. It must not be expected that accurate series of angles taken to different points will always exactly agree, when carefully plotted upon the chart, especially if the lines to objects be long. The larger the chart the greater the amount of this distortion.

Buoys.—It is manifestly impossible that reliance can be placed on buoys always maintaining their exact position. Buoys should therefore be regarded as warnings and not as infallible navigating marks, especially when in exposed positions; and a ship should always, when possible, be navigated by bearings or angles of fixed objects on shore and not by buoys.

Lights.—All the distances given in the Light Lists and on the charts for the visibility of lights are calculated for a height of an observer's eye of 15 feet. The table of distances visible due to height, at end of each Light List affords a means of ascertaining how much more or less the light is visible should the height of the bridge be more or less. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances.

When looking out for a light at night, the fact is often forgotten that from aloft the range of vision is much increased. By noting a star immediately over the light a very correct bearing may be afterwards obtained from the standard compass.

The intrinsic power of a light should always be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by remarking its order, as given in the Light Lists, and in some cases by noting how much its visibility in clear weather falls short of the range due to the height at which it is placed. Thus, a light standing 200 feet above the sea and only recorded as visible at 10 miles in clear weather, is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles, if of any power. (*See table in Light List above-mentioned.*)

Fog Signals.—Sound is conveyed in a very capricious way through the atmosphere. Apart from wind, large areas of silence have been found in different directions and at different distances from the origin of a sound, even in clear weather. Therefore too much confidence should not be felt in hearing a fog signal. The apparatus, moreover, for sounding the signal often requires some time before it is in readiness to act. A fog often creeps imperceptibly towards the land, and is not observed by the people at a lighthouse until it is upon them; whereas a ship may have been for many hours in it, and approaching the land. In such a case no signal may be sounded. When sound has to travel against the wind, it may be thrown upwards; in such a case, a man aloft might hear it when it is inaudible on deck.

Taken together, these facts should induce the utmost caution in closing the land in fogs. The lead is generally the only safe guide.

Tides and Tidal Streams.—In navigating coasts where the tidal range is considerable, caution is always necessary. It should be remembered that there are indraughts to all bays and bights, although the general run of the stream may be parallel to the shore.

The turn of the tidal stream off shore is seldom coincident with the time of high and low water on the shore. In open channels, the tidal stream ordinarily overruns the turn of the vertical movement of

the tide by three hours, forming what is usually known as tide and half-tide, the effect of which is that at high and low water by the shore the stream is running at its greatest velocity.

In crossing a bar or shallow flats, the table (B) at page 98 of the Tide Tables will be found of great assistance in calculating how much the water has risen or fallen at any hour of the tide.

On coasts where there is much diurnal inequality in the tides, the amount of rise and fall can never be depended upon, and additional caution is necessary.

It should also be remembered that at times the tide falls below the level of low-water ordinary springs. This always occurs in temperate regions at the equinoxes, but wind may produce it at any time, and the amount varies with locality. When the moon's perigee coincides with the full or new moon the same effect is often produced.

Fixing Position.—The most accurate method of fixing a position relative to the shore is by angles between well-defined objects on the chart. All ships are now being supplied with a station pointer, and this method should be used whenever possible.

Two things are, however, necessary to its successful employment. First, that the objects be well chosen; and second, that the observer is skilful and rapid in his use of the sextant.

For the former, reference can be had to the pamphlet on the use of the station pointer, which is in every chart box.

The latter is only to be obtained by practice.

It will readily be seen that in war time, when the compass may be knocked away, or rifle-fire may make it undesirable to expose the person more than necessary, a sextant offers great advantages, as angles can be obtained from any position whence the objects are visible. It is this contingency that makes it especially desirable that all navigating officers should become expert in this method of fixing a ship's position.

In many narrow waters also, where the objects may yet be at some distance, as in coral harbours or narrow passages among mud banks, navigation by sextant and station-pointer is invaluable, as a true position can only be obtained by its means. A small error in either taking or plotting a bearing under such circumstances may put the ship ashore.

It is not intended that the use of the compass to fix the ship should be given up; there are many circumstances in which it may be usefully employed, but errors more readily creep into a position so fixed.

In all cases where great accuracy of position is desired, angles should invariably be used, such as the fixing of a rock or shoal, or of additions to a chart, as fresh soundings or new buildings. In all such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained not only prevent any errors, but they at once furnish a means of checking the accuracy of the chart itself. In the case of ordinary soundings, it is only necessary to take a third angle now and then; firstly, to check the general accuracy of the chart as above stated; secondly, to make certain that the more important soundings, as at the end of a line, are correctly placed.

Sometimes, when only two objects are visible, a compass bearing and sextant angle may be used with advantage.

In passing near a point of land, or an island, the method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "four-point bearing," when the bearing is taken four points on the bow, and on the beam, the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives an excellent fix for a departure, but does not ensure safety, as the point, and probably the rocks off it, are abeam before the position is obtained.

By taking the bearings of two points and four points on the bow, a very good position is obtained before the object is passed; the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current.

A table of factors, by which to multiply the distance run, to obtain the distance of the object when any number of degrees between the two bearings has been observed, is now supplied in all chart boxes.

The use of a danger angle in passing outlying rocks with land behind should also not be forgotten. In employing this method, however, caution is necessary, as should the chart be not accurate, *i.e.*, should the objects selected be not quite correctly placed, the angle taken off from it may not serve the purpose. It should not, therefore, be employed when the survey is old or manifestly imperfect.

In fixing by the compass, it must always be remembered that two bearings only are liable to error. An absolute error may be made in either bearing observed; errors may be made in applying the deviation; or errors may creep in in laying them on to the chart. For these reasons, a third or check bearing of some other object should be taken, especially when near the shore or dangers. The coincidence of these three lines will prevent any mistakes.

In ships still fitted with the Admiralty standard compass, the tripod supplied to hold the lamp will be found of great service in fixing position at night, as by its aid a bearing can be as accurately taken as in daylight. Its use in connection with ascertaining the change of bearing of an approaching ship's light should not be forgotten.

Amongst astronomical methods of fixing a ship's position, attention is drawn to the great utility of Sumner's method. A Sumner line, that is, a line drawn through the position (obtained by an assumed latitude and longitude by chronometer) at right angles to the bearing of the sun, as obtained from the azimuth tables, gives at times invaluable information, as the ship must be somewhere on that line, provided the chronometer is correct. A deep cast at the same time may often serve to get an approximate position on the line. An early and very accurate position can be also obtained by Sumner's method, by getting longitude by a bright star at daylight when the horizon is well visible, and another longitude by the sun when a few degrees above the horizon, or by observing two or more stars at twilight. The Sumner lines drawn through the two positions thus obtained will, if the bearing of sun and star differ three points or more, give an excellent result.

Current Arrows on charts only show the most usual or the mean direction of a tidal stream or current. It must never be assumed that the direction of a stream will not vary from that indicated by the arrow. In the same manner, the rate of a stream constantly varies with circumstances, and the rate given on the chart is merely the mean of those found during the survey, possibly from very few observations.

Change of Variation of the Compass.—The gradual change in the variation must not be forgotten in laying down positions by bearing on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and

in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change, may be of importance. The compasses are re-engraved when the error amounts to a quarter of a point, but the chart plates cannot be corrected more frequently from the impossibility of making alterations too often on one spot in a copper plate.

The geographical change in the variation is in some parts of the world sufficiently rapid to need consideration. For instance, in approaching Halifax from Newfoundland the variation changes 10° in less than 500 miles. The variation chart should be consulted on this head.

Local Magnetic Disturbance of the Compass on board Ship.—The term “local magnetic disturbance” has reference only to the effects on the compass of magnetic masses external to the ship in which it is placed. Observation shows that disturbance of the compass in a ship afloat is experienced only in a few places on the globe.

Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such rapid proportion as the distance from it increases, that it would require a local centre of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow and the force strong, the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centres near together.

The law which has hitherto been found to hold good as regards local magnetic disturbance is, that north of the magnetic equator the north end of the compass needle is attracted towards any centre of disturbance; south of the magnetic equator it is repelled.

It is very desirable, that whenever a ship passes over an area of local magnetic disturbance, the position should be fixed, and the facts reported as far as they can be ascertained.

Use of Oil for Modifying the Effect of Breaking Waves.—Many experiences of late years have shown that the utility of oil for this purpose is undoubted, and the application simple.

The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil, skilfully applied, may prevent much damage both to ships (especially the smaller classes) and to boats, by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows :—

1. On free waves, *i.e.*, waves in deep water, the effect is greatest.
2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain ; as nothing can prevent the larger waves from breaking under such circumstances ; but even here it is of some service.
3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use ; crude petroleum is serviceable when nothing else is obtainable ; but all animal and vegetable oils, such as waste oil from the engines have great effect.
4. A small quantity of oil suffices, if applied in such a manner as to spread to windward.
5. It is useful in a ship or boat, both when running, or lying to, or in wearing.
6. No experiences are related of its use when hoisting a boat up in a sea-way at sea, but it is highly probable that much time and injury to the boat would be saved by its application on such occasions.
7. In cold water, the oil, being thickened by the lower temperature, and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.
8. The best method of application in a ship at sea appears to be : hanging over the side, in such a manner as to be in the water, small canvas bags, capable of holding from one to two gallons of oil, such bags being pricked with a sail needle to facilitate leakage of the oil.

The position of these bags should vary with the circumstances. Running before the wind they should be hung on either bow—*e.g.*, from the cathead—and allowed to tow in the water.

With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying to, the weather bow and another position farther aft seem the best places from which to hang the bags, with a sufficient length of line to permit them to draw to windward, while the ship drifts.

9. Crossing a bar with a flood tide, oil poured overboard and allowed to float in ahead of the boat which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances the effect cannot be so much trusted.

On a bar with the ebb tide it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current, and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil is diffused well ahead of the boat, and the bag can be readily hauled on board for refilling if necessary.



For later information respecting the lights included in this work, seamen should consult the Admiralty List of Lights, Part II., for the North Sea, Baltic, &c. This Light List is published early in the current year, corrected to the preceding 31st December.

SO 11363D—1000—10/91 Wt 14562 D & S.

NORTH SEA PILOT.

PART IV.

CHAPTER I.

GENERAL DESCRIPTION AND NAVIGATION.—WINDS AND WEATHER,
WITH SIGNALS.—ICE.—CURRENT.—TIDES AND TIDAL STREAMS.
—WRECKS.—BUOYAGE.—TIDAL SIGNALS.—ROUTES.

The **NORTH SEA** is bounded on the west by the British isles, on the east by Norway and Denmark, on the south by Germany, Holland, Belgium, and France, and on the north by the Shetland isles and the Northern or Arctic ocean. The term "German ocean," formerly in common use, is not so comprehensive in its application to this extensive basin as that of "North sea," now generally used by navigators. Lying between the parallels of 51° and 61° N., and longitudes $2^{\circ} 30'$ W., and $8^{\circ} 30'$ E., its greatest length is about 600 miles, and its breadth (from St. Abbs head to Hantsholm on the opposite shore of Denmark) 360 miles. The shores of the North sea are indented by bays, fiords, inlets, and estuaries; and the Skagerrak, an arm of it dividing Denmark and Norway, communicates through the Kattegat, with the Baltic.

If the North sea be divided into two unequal portions by a line drawn from Cromer to the Texel; the northern part will be found to possess a comparatively uniform depth; the southern section, on the contrary, while limited in area, is the receptacle of several considerable rivers, such as the Thames, Schelde, and Maas, and is encumbered with sand-banks, rendering its navigation difficult, and even impracticable for heavy draught ships, without artificial marks.

The general depths are very moderate with the exception of the remarkable deep gutter skirting the Scandinavian coast, where they vary from 130 to 270 fathoms. The depths decrease from north to south, but the bottom of the entire basin is very irregular, and large portions of the southern part are encumbered with banks and shoals, which render the navigation, in connection with the weather that prevails, difficult and dangerous.*

Among the sand-banks in the northern portion of the North sea is the one known to mariners as the Long Forties, which trends from the Firth of Forth north-easterly for about 110 miles, while the Jutland banks may be traced for upwards of 100 miles in a westerly direction. Besides the great central mass known as the Dogger bank, there are

* See Admiralty charts :—North sea, general, No. 2,339; also Nos. 2,182, *a* and *b*; scale, *m* = 0.1 of an inch; Dover and Calais to Orfordness and Scheveningen, No. 1,406; scale, *m* = 0.3 of an inch.

a great number of shoals and sand-banks lying southward of the line joining Flamborough head and Heligoland; though too numerous to be particularized here it may be mentioned that off the coasts of Britain, France, and Belgium, they generally assume the form of ridges trending nearly parallel to the shore or the tidal streams, while the coast of North Holland is fronted by a broad flat.

GENERAL NAVIGATION.—The navigation is difficult in the south-eastern portion of the North sea, arising partly from the shores being so low as seldom to be visible to a greater distance than 10 or 12 miles, even in clear weather; and partly to the prevalence of fogs and misty weather during certain portions of the year, this imparts to the navigation a critical character, and renders necessary the utmost caution and vigilance on the part of the mariner, a fact abundantly evidenced by the number of wrecks which annually takes place within its limits.

It is well to remember also, that, as a general rule, the traffic is becoming more and more restricted to steam-vessels and they may be expected to cross the general line of traffic up and down the sea, in certain localities. For instance, the ports in the Humber keep up a constant communication with Holland, Norway, and the Baltic. Harwich has a line of steamers running to Antwerp; from the Tyne steamers run constantly to the continent, Baltic, and Norway, whilst fishing craft congregate in great numbers on the Broad Fourteens, off the Texel, and also, off the Horn reefs, so that in these localities extra caution is necessary especially in thick weather.

The navigators' chief reliance will be found to be in the lead, log, and lookout, and a careful study of the tidal streams, as regards their strength and moment of change of direction (*see* page 12), and on the attention bestowed upon these points the safety of the ship will principally depend.

While closing the coasts, either to the eastward or to the westward, due allowance must be made for the set of the tidal streams (*see* page 12), and when at all uncertain as to position, it must be held as far safer to "heave to" than to run on, or, in case of falling into shallow water, to anchor rather than to keep under weigh; the loss of a few hours in the passage, or the trouble of weighing an anchor, ought never, for a single moment, to be allowed to prevail against the risk of perilling life and property.

WINDS and WEATHER.—The description of the wind and weather for the east coast of the United Kingdom is given in North Sea Pilot, part III., fifth edition, 1889, and as this also is descriptive of the general conditions over the whole of the North sea, it is here repeated, for those who have not that book at hand.

The winds and weather may be considered from three points of view—(1) the general direction of the wind throughout the year, (2) the prevailing types in summer and winter, and (3) the disturbances occurring at all seasons of the year.

With regard to the general direction of the wind, as well as to the prevailing types, in summer and winter, it is now well established that the course of the wind and the pressure of the atmosphere are intimately connected, the wind having a tendency to circulate round areas of high and low pressure, but in different directions; the circulation round the low pressure areas (following invariably the law that holds good in hurricanes and cyclones) is known as the cyclonic system; and that round high pressure areas (exactly contrary to the low pressure system) is termed anticyclonic.

It follows, therefore, that if the distribution of pressure be known, the direction of the wind can be readily ascertained, and *vice versa* if the direction of the wind be known, the direction in which the high and low pressure areas are situated can be determined. A knowledge of this fact is of great importance to the seaman, as he is thus able to avoid standing towards a low barometer, when in his opinion his so doing might lead his vessel into danger. This law, known as Buys Ballot's law, from the meteorologist who first promulgated it, is extremely simple. It is merely "if the face of an observer be directed to the wind, the low pressure area will be on his right, and the high pressure area on his left, in the northern hemisphere;" whilst in the southern hemisphere the low pressure area will be on his left, and the high pressure area on his right.

When considering the mean distribution of pressure and the mean annual direction of the wind, it is necessary to study the varying conditions of the wind and pressure over considerable tracts; thus over the British isles the direction of the wind approximates to the general circulation of the atmosphere on the adjoining continent—for as the mean pressure in the neighbourhood of Iceland is low, the wind circulates round this low pressure area, consequently the prevailing wind in Greenland is northerly and easterly, on the Danish and Norwegian coast south and south-easterly, and over the British islands west and south-westerly. In accordance therefore with Buys Ballot's law, the mean atmospheric pressure should decrease from the south towards the north, and this observation proves to be the case, as the mean annual pressure at the Shetland isles is 29.78, increasing steadily to 29.96 at Dungeness, the Isle of Wight, Portland and the Start.

Although the mean annual direction of the wind is from the west, easterly winds are by no means uncommon. In point of fact the

wind and weather may be divided into two types ; the westerly and the easterly, one of which is generally prevailing over the North sea. With the westerly type of wind the atmospheric pressure is lowest over Iceland, and highest to the southward of the British isles ; whilst with the easterly type the pressure is highest in the north, and lowest in the south. The westerly type is most common during the months December, January, February, July, August and September ; whilst the easterly type is most common in March, April, May, and November ; June and October may be regarded as intermediate months. The characteristic of the westerly type is that the wind commencing at some point of south, with a comparatively high temperature, a dull sky and rain, veers to some point of west with a cooler air and brighter sky, and after a day or so of fine weather backs again to the south with bad weather, sometimes rising to the intensity of a gale, and so on for weeks together.

The characteristic of the easterly type is that the wind fluctuates between S.E. and N.E., the S.E. winds bringing foul weather and the N.E. finer weather, veering and backing with many variations for a considerable period. The change from the easterly to the westerly type is often preceded by a movement in the upper clouds. If, with the easterly type prevailing, cirrus and stratus clouds be seen moving from west to east a change is nearly certain to follow.

Land and sea breezes are not phenomena of regular occurrence on the shores of the North sea, but are occasionally observed in fine settled weather during the summer.

Although as previously stated the westerly type of wind is most common in certain months, and the easterly in others, the variable nature of the climate over the North sea does not permit us to predict that such a type will be certain to prevail during the period in which it is most common. A general outline of observed facts is all that meteorology can at present give with certainty ; as forecasts for even 24 hours cannot be implicitly relied on.

Gales or strong winds are by no means unfrequent ; they are usually accompanied by the depressions visiting the British isles, the greatest number of which pass between Ireland and the North-west coast of Scotland, with gales from S.E., shifting to S.W. ; but it is by no means uncommon for them to pass across Great Britain when in that portion of the island, and North sea. To the southward of their track, the wind will veer to the southward and westward, whilst to the northward of their track it will back to east, N.E., and N.W. Seamen must be guided in their judgment as to the track of the depression by frequent observations of the barometer and the force and direction of the wind, constantly bearing in mind

Buys Ballot's law, previously mentioned, and remembering that the harder it blows the greater is the barometric gradient. The usual track of depressions in the vicinity of Great Britain is from some westerly point to some easterly point, but the reverse takes place occasionally, and they have been known to cross Great Britain on the north, travel to the southward in the North sea and pass down the English channel to the westward.

For Storm signals, *See* page 6. For Life-boats and rescue stations, *See* page 26.

FOGS may occur at all seasons of the year, but are most common when anticyclonic conditions prevail, especially in the winter. Thick weather, approaching to a fog, is very common. The N.E. winds of spring bring, as a rule, the clearest weather.

Caution respecting fog signals from light-vessels or lighthouses.—Although every endeavour is made to start fog signals as soon as possible after signs of fog have been observed, mariners should not, when approaching the land or light-vessels in a fog, rely implicitly upon these fog signals. They should also remember that the distance at which sound can be heard in a fog, varies exceedingly; and that, in some apparently light fogs, a fog signal will not be heard so far, as in some very dense ones.

Too much confidence should not, therefore, be placed in getting warning by such signals, and on no account should the use of the lead be neglected.

BRITISH STORM SIGNALS.—The South cone (a cone point downwards) means that gales, or strong winds, are probable, at first from the southward (from south-east, round by south, to north-west). Should it appear likely that a gale beginning from between west and north-west is likely to veer northward or north-eastward, the North cone is hoisted in preference to the South cone.

The North cone (a cone point upwards) means that gales, or strong winds, are probable, at first from the northward (from north-west, round by north, to south-east). Should it appear likely that a gale beginning from between east and south-east is likely to veer southward or south-westward, the South cone is hoisted in preference to the North cone.

The storm signals are hoisted on information received by telegraph from the Meteorological Office, and are, if not subsequently directed to be lowered, kept up for 48 hours.

As weather information is only received at the Meteorological Office, at 8h. a.m., 2h. p.m., and 6h. p.m., a gale may have reached a station and passed on during the night, before the Meteorological Office is in a position to order the signal to be lowered.

These storm signals only refer to the greater and more general disturbances which may appear to be approaching. Local winds of gale force may occur for which no warning can be given, and observers must watch their own barometers, and local signs of weather.

Night storm signals.—The signals consist of three *red* lights, exhibited in the shape of a cone:—Three *red* lights, point downwards, indicate the same as South cone, point downwards, by day, or that gales or strong winds are probable, first from the southward, viz., from S.E. round by South, to N.W. Should it appear probable that a gale, beginning between West and N.W., is likely to veer towards North or N.E., the North cone is hoisted in preference to the South cone.

Three *red* lights, point upwards, indicate the same as North cone, point upwards, by day, or that gales or strong winds are probable, first from the northward, viz., from N.W., round by North, to S.E. Should it appear probable that a gale, beginning between East and S.E., is likely to veer towards South or S.W., the South cone is hoisted in preference to the North cone.

FRENCH STORM SIGNALS.—These signals resemble those formerly in use on the English coasts where, however, the cone only is now used; they are made at the harbours and signal stations, and remain hoisted 48 hours from the time of receiving notice from the Ministry of Marine. The signals are made with a cone and drum painted black, which, when hoisted, appear as a triangle and square; thus:—



Southerly gale.—The cone point downwards means that strong winds are probable, at first from the southward (from S.E. round by South to N.W.).



Northerly gale.—The cone point upwards means that strong winds are probable, first from the northward (from N.W. round by North to N.E.).



Very heavy gales.—The drum is hoisted with the cone whenever a very heavy gale, southerly or northerly as the case may be, is probable (with southerly gales above the cone, with northerly gales below the cone).

The drum is not used without the cone.

Sudden shifts of wind.—No signal is employed to indicate a wind which is likely to shift suddenly, but it must be remembered that a southerly wind is much more likely to veer to a point northward of West, than a northerly wind is to veer to a point southward of East. Consequently, when the South cone is hoisted and a vessel

is at an anchorage open to the N.W. it is well to be prepared for the gale being finally from that quarter.

Meaning of signals.—The hoisting of any of these signals is intended as a sign that there is an atmospherical disturbance in existence which will probably cause a gale from the quarter indicated by the signal used, in the neighbourhood, say within a distance of 50 miles, of the place where the signal is hoisted, and the knowledge of which is likely to be of use to the sailors and fishermen on that part of the coast. Its meaning is simply, “look out! It is probable that bad weather of such and such a character is approaching you.”

French weather signals.—The following weather signals, in addition to the established storm warnings, have been adopted at the signal stations and at the principal ports and shipping places :—

1. A flag, of any colour, indicates—Weather doubtful, barometer inclined to fall.
2. A short pennant (cornet) „ Appearance of bad weather, heavy sea, barometer falling.
3. A pennant indicates—Appearance of better weather, barometer rising.
4. A flag above cornet „ The entrance of the port has become dangerous.
5. A flag below cornet „ The life-boat is coming out.

NOTE.—In fine settled weather no signal is made.

NETHERLANDS WEATHER SIGNALS.—At the principal ports, a pillar with movable arms denotes the direction of both high and low barometric pressure, and angle of the gradient.

In a frame near the pillar is a record of the two previous days' observations, to enable the seaman to judge of the probable weather for himself.

GERMAN STORM SIGNAL STATIONS.—The following storm signal stations have been established on the North sea coast of Germany. They are divided into two classes; those of the first class having a signal staff, with a yard, to which the signals are hoisted; and those of the second class, a post, to which a ball is hoisted, as a signal that a storm is approaching, of which information may be obtained at the signal station.

A signal signifies that in the neighbourhood of the locality where it is shown, within a circuit of about 100 miles radius, a storm from the direction indicated is probable.

Name of Station.	Class.	Latitude N. (approximate.)	Longitude E. (approximate.)	Remarks.
Keitum - - - (Sylt)	2	54 54	8 22½	Signal post is at west angle of signalman's house.
Tönning - - -	2	54 19	8 58	Signal post on Robbenberge near the entrance of the harbour.
Glückstadt - - (Elbe river)	1	53 47½	9 25	The signal staff is on the north dike, at the harbour.
Altona - - -	1	53 32½	9 57	The signal staff is at the west end of pontoon; steamer wharf.
Hamburg - - -	1	53 32½	10 0	The signal staff is in front of the Sailor's Home. Principal Signal Station on German coast.
Brunshausen - -	2	53 38	9 31	The signal post is at the ferry-house.
Cuxhaven - - -	1	53 52½	8 42	The signal station is at the pilot watch-house.
Weser lighthouse - (Eversand)	1	53 45	8 21	The signals are hoisted to a yard attached to the lighthouse.
Bremerhaven - -	1	53 33	8 34	The signals are hoisted to a yard, attached to the lighthouse.
Geestemünde - -	1	53 32	8 35	The signal staff is on the dike in front of the Harbour-master's house.
Brake - - -	2	53 19	8 28	The staff is near the Harbour-master's house.
Wilhelmshaven -	1	53 31	8 9	The signal staff is near the first sluice.
Wangeroog - - -	1	53 47½	7 54	The signal staff is on the Dünen beacon.
Friedrichsschleuse Carolinsiel	2	53 42	7 48	The signal post is attached to the signalman's house
Nordeney - - -	1	53 42½	7 9	The signal staff is at the north-west end of the island.
Nesserland - - (near Emden)	1	53 21	7 11½	The signal staff is close to the Nesserland sluice.
Borkum - - -	1	53 35	6 39½	The signal staff is at the western end of the island, near the life-boat station.

GERMAN STORM SIGNALS.—The following are the storm signals in use on the coasts of Germany :—



Southerly gales are indicated by cones apex downward ; one cone so displayed indicates a gale expected from S.W.



Two cones vertically, with apex downward, indicates a gale expected from S.E.



Northerly gales are indicated by cones apex upward ; one cone so displayed indicates a gale expected from N.W.



Two cones vertically, with apex upward indicates a gale expected from N.E.

One flag, indicates that the wind will probably shift ; from north, through east, and south, to westerly directions.

Two flags, indicate that the wind will probably shift ; from north, through west, and south, to easterly directions.

A ball indicates that an atmospheric disturbance is present.

DANISH STORM SIGNALS.—A drum hoisted alone indicates that a storm is expected, without stating from what quarter.

A drum above a cone with its point downward, that a storm is expected from the South.

A drum under a cone with its point upward, a storm is expected from the North.

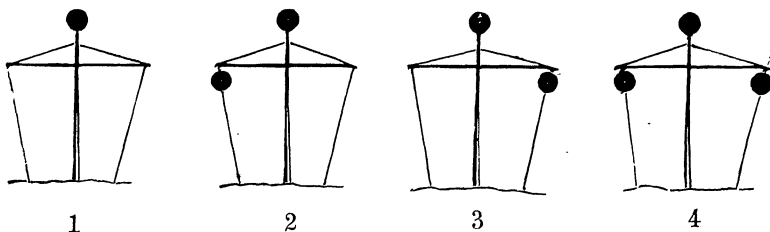
Danish storm signals for fishing vessels.—The following stations have been established on the west coast of Jutland, for the

purpose of warning those in fishing vessels of approaching storms ; also to indicate the spots where landing is practicable.

Name of Station.	Latitude N. (approximate).	Longitude E. (approximate).	Remarks.
Nyminde - -	55 48	8 11½	Northward of the Rescue Station.
Bjerggaard - -	55 54	8 10	One mile southward from Haurvig beacon.
Aargab - -	55 57	8 8½	N.N.W. 1¼ miles from Haurvig Chapel.
Lyngvig - -	56 3	8 5½	Two-thirds of a mile W. by N. ½ N. from Lynvig Chapel.
Söndervig - -	56 8	8 7	W. by N. ½ N. 2⅔ miles from Ny Sogn Church.
Vødersö - -	56 15½	8 8	N.W. by N. 200 yards from the beacon.
Knopper - -	56 40	8 10	
Agger - -	56 47	8 14	N.W. by N. 800 yards from Agger Church.
Vörupor - -	56 57	8 22	Northward, 70 yards from the Rescue Station.
Klitmøller - -	57 3	8 29	Three-quarters of a mile N.W. by W. from Klitmøller Church.
Hanstholm - -	57 7	8 37	N. by W. 600 yards from the lighthouse.
Bavn - -	57 7	8 40	Half-a-mile E. by N. from Hierte-bierg hill.
Blokhus - -	57 15½	9 35	One-third of a mile S.W. by W. from the beacon.
Lökken - -	57 22½	9 43	N. by E., 400 yards from the beacon.
Lönstrup - -	57 28	9 49	One mile N.E. by E. from Maarup Church.
Tornby - -	57 33	9 55	S.W. by W., 2½ miles from Hirtshals lighthouse.
Hirtshals - -	57 35	9 58	Two-thirds of a mile E. by N. from the lighthouse.
Uggerby - -	— —	— —	One mile N.W. by W. from Uggerby Church.
Vester Twærsted -	57 34½	10 8	W. by N., 1½ miles from Twærsted Church.

The signals are shown from a mast with yards, and consist of one, two, or three balls by day ; and one, two, or three white lights by

night. In thick weather a horn is sounded, and a gun fired by day, and rockets by night.



1. The sea is rising, but landing here is still possible.
- 2, 3. There is danger ; seek landing along the coast in direction of the ball or light at the yard-arm.
4. Expect the life-boat.

Sound signals from a horn :—

No. 1. By three long notes.

„ 2. By one short and one long note.

„ 3. By one long and one short note.

„ 4. By one long, two short, and one long note.

The landing places are marked by day by two red and white flags in line ; and by night by two red lights in line. In thick weather three long notes of the horn, as in signal No. 1.

ICE.—Information respecting ice in the rivers is given in the description of each river (*refer* to index). But it may be here remarked that the navigation of them may be interrupted at any time between the middle of November to the middle of March.

Winter buoyage.—When ice prevails the light-vessels and buoys have to be removed, but are replaced as soon as practicable ; and in important places specially constructed spar buoys are substituted.

The CURRENT in the North sea in general is sensibly affected by the winds, a circumstance particularly necessary to be attended to by those bound from the British shores towards the opposite coast. With winds from the south-west quarter the current sets north-eastward, generally across Jutland bank and the south side of the Skagerrak towards the Skaw ; or, varying its direction with the wind, trends towards the coast of Norway. It is therefore necessary to be careful to ascertain that the vessel is not set ahead of the reckoning, and every attention should be paid to the lead.

That prevailing westerly winds have the effect of producing a surface or drift current (apart from tidal phenomena) has also been observed on the coast between Horn reefs and the Texel ; and it seems to be further considered that this drift current flows out again

to the northward, along the coast of Schleswig-Holstein, but that it is not of a permanent character.

The current along the coast of Jutland northward of Bovbjerg (lat. $56^{\circ} 31' N.$) sets with westerly winds about 2 miles an hour, and with strong S.S.W. gales more than 3 miles. Between Jutland bank and the coast of Norway it generally sets to the westward even during westerly winds, and at the same time the current on the Jutland coast sets eastward.

With northerly and north-westerly winds it sets southward along the coast of Norway, over the Jutland bank, and along the coast of Jutland towards Heligoland. In strong winds or gales this current runs at the rate of $1\frac{1}{2}$ or 2 miles an hour, and requires particular caution.

Between the Naze of Norway and the Orkney islands the current is very uncertain; it flows with the wind, particularly when it blows from the northward or southward; but generally it runs strongest to to the northward. As the wind continues the current increases, and after long continued south-west winds, it sometimes runs more than 2 miles an hour midway between the Naze and Orkneys. Easterly or westerly winds blowing athwart this current sometimes render it almost insensible in the offing; and within 9 to 12 miles of the islands, the tides take that regular course which they keep between the Orkneys and Shetland islands.

TIDES and TIDAL STREAMS.—When considering the rise and fall of the tide; and the direction the stream may be running at any given hour; the navigator must deal with each as a separate subject.

Although the North sea is open to the tidal undulation passing round the north extreme of Scotland, it is apparently the English channel undulation that runs in a north-easterly direction along the coast of France, Belgium, Holland, Germany and Denmark, causing a rise of 19 feet at Calais, diminishing to one foot at the Skaw; the southern part, however (or in the space enclosed by lines drawn from Orfordness to the Texel, and cape Gris Nez to Dover) is affected by both tidal undulations.*

* Tidal datum of French charts of the French coast:—The soundings on French charts are reduced to the level of the lowest tides known, *i.e.*, lower than mean equinoctial springs.

The Admiralty charts for the French coast being founded on the French, adopt the same datum.

The tidal rise is, therefore, given from this datum, and the spring rise is greater than the spring range, and not the same as is the case in Admiralty charts in general, and the depths at low water ordinary springs are always greater than shown on the charts.

The French tides are calculated from a quantity which is called *Unité de Hauteur*, and which is the half range of the tide at mean equinoctial springs.

No allusion to this is, however, made in the Admiralty charts.

It has not yet been ascertained by any decisive experiments whether the range of the tides between the northern coast of France and the estuary of the Thames is equal to that observed on the surrounding shores. All that is positively known on the subject is, that as far as 15 or 16 miles from the French coast, the vertical motion of the tides seems to follow very nearly the same law as on the shore ; they take place at the same times and appear to rise in an equal degree ; but, if the rise of water, at springs, on this coast, at Calais for example, is compared with that observed at the same tides on the coasts of Belgium and Holland, as well as at several positions in the estuary of the Thames, and especially at Orfordness, it would appear that beyond the distance of 15 or 16 miles from the French coast, in a N.N.E. and E.N.E. direction, the range of tide decreases in the same manner as on the shores.

It is even probable that this decrease is very rapid, for in the middle of the North sea, in latitude $52^{\circ} 27\frac{1}{2}'$ N., longitude $3^{\circ} 14\frac{1}{2}'$ E., Captain Hewett found, in 1840, that the rise and fall did not exceed 3 feet.

Further observations as to the rise and fall in the open parts of the North sea are required before a definite rule can be laid down, but it is very improbable that the tidal range off-shore is the same as on the coast, and caution is therefore requisite in diminishing the depths obtained at high water, in order to compare them with the depths on the chart.

Along the continental shore of the North sea the tidal wave has this peculiarity ; whilst at Ostende, with a rise of 17 feet at springs, the undulation is normal ; as the wave advances eastward the low water-stand gradually increases in length, until at the Hook of Holland, where the rise at springs is but 5 feet, the tide stands at low water for 3 hours.

From the Hook of Holland, eastward, this peculiarity becomes gradually reversed ; the low water-stand occupying less and less time, and the high water-stand more and more, until the entrance to the Texel is reached, where the rise at springs is 4 feet, and the tide stands at high water for 3 hours. Eastward of the Texel again, the time occupied by high water-stand gradually decreases, until Rottum is reached, where the springs rise $7\frac{1}{2}$ feet, and the tidal wave again becomes normal.

The above peculiarities are probably due to the undulation which advancing up channel, and passing through Dover strait, meets the undulation which travels southward along the east coast of Great Britain. Two opposing waves thus become superimposed at certain times and places, whilst at others they are widely separated.

The streams.—The set and direction of the tidal streams along the shores appears to be very perplexing if it is referred to the high waters of the several ports. The general notion that the stream runs swiftly in one direction whilst the tide is rising, and in the opposite direction whilst the tide is falling, and of its having little or no motion at the times of high and low water, is an entirely erroneous one, when dealing with a tide travelling along what is practically a great estuary, for in many places the stream is strongest when it is high or low water by the shore. This is particularly noticeable along the shore between cape Gris Nez and the mouths of the river Maas, details of which will be found in the body of this work, in the descriptions of the several ports.

Only the general direction of the tidal streams will be described here, as minute details would perhaps tend rather to confuse than assist. The principal information required by the practical seaman is—in what direction is the tidal stream setting? at what rate? and when will it turn in another direction?

Between a line joining the Leman and Ower light-vessel and the Texel; and another joining the North Foreland and Dunkerque the stream will be found to be setting north-easterly, from one to 6 hours *after* high water at Dover, and south-westerly from 5 hours to one hour *before* high water at Dover, the rate near Dover strait is $2\frac{1}{2}$ to 3 knots per hour, lessening to $1\frac{3}{4}$ knots further north; this is the greatest rate at springs, when not affected by the winds. Near the shore between Terschelling and the Maas, it is stronger than in the open sea.

The “Heligoland stream” (between the Texel and the Elbe) sets westward from one to $1\frac{1}{2}$ knots (greatest rate at springs), from one to 6 hours *after* high water at Dover, meeting the East channel stream off the Texel, where both flow together in a north-westerly direction. From 5 hours to one hour *before* high water at Dover, the stream sets eastward from Texel to the Elbe, but sets hard on Terschelling the 1st and 2nd hour before high water at Dover.

Northward of 54° N., there is not much tidal stream in the offing of the part described in this volume, about a half to one knot is the greatest rate and the direction variable. For the streams alongshore from the Elbe to Horn reefs, *see* page 212.

From tidal observations made in the German war vessel *Drache*, in June 1881, it appears that in the deep water south-east and east of the Dogger bank, the tidal stream near the bottom was observed

to run with the same velocity as on the surface, and to turn regularly.

Caution.—Mariners should bear in mind that the direction of the tidal stream in the offing, in the North sea, is not to be taken as a sign of the rise or fall of the tide; for, the vessel would be exposed to the greatest danger by running with what might be considered to be the flood stream towards a shoal lying far from the land, under the idea that in consequence of the direction of the stream the water was rising on that shoal, and that it might be crossed. This stream only ceases to be felt in the vicinity of some of those banks which are furthest out from the coasts of France and Belgium, when it is nearly low water on the shore.

When desirous of crossing a bank lying within 15 or 16 miles of the French or Belgian coast, an approximate calculation should always be made of the number of feet the tide has risen above the soundings shown on the chart. An useful table for readily computing this, will be found in the Admiralty tide tables, page 98, Table B, published annually.

DANGEROUS SUNKEN WRECKS.—The large steamers *Gaw Quan Sia* and *Leerdam* collided in the North sea in a fog on 16th December 1889, both eventually sinking within a mile of one another. They have since been reported in several positions, but that reported by the salvage steamer *John Dixon* on 8th January 1890, in lat. $51^{\circ} 58' N.$, long. $3^{\circ} 2' E.$, (the latitude observed at noon alongside the wreck of the *Gaw Quan Sia*, and the longitude by dead reckoning,) appears to be the most accurate. In January 1890 the portions of the topmasts originally showing above water were broken off, and nothing remained to show the positions of the wrecks. There is, however, no doubt that the heads of the four lower masts, which are of iron, present a great danger to shipping. The depth alongside the *Gaw Quan Sia* was 19 fathoms, and alongside the *Leerdam* about one fathom less, and both vessels were quite upright when last seen. The wreck of *Gaw Quan Sia* has been placed on Admiralty charts in lat. $51^{\circ} 58' N.$, long. $3^{\circ} 2' E.$ The other wreck one mile to N.N.W., and a note, "one fathom over iron masts," position approximate written against them.

As these wrecks lie, whatever their precise positions, in the track of vessels passing through the North sea between the strait of Dover and the north, and in other directions, the greatest care is necessary to avoid passing near the position given.

Caution.—Several sunken wrecks lie in the fairway of those coasting between the Schelde and the Elbe, also, in other parts of the North sea; these are placed upon the charts and the positions shown should be carefully avoided.

SYSTEMS OF BUOYAGE.

FRENCH UNIFORM SYSTEM of BUOYAGE.—All the buoys and beacons (termed herein “marks”) are characterised by colour, and by the form of topmark. The term *starboard* means the right hand side approaching from seaward; the term *port* means the left hand side. The term *outer end of middle ground* is given to the marks placed at the seaward extreme of middle grounds; those at the inshore extreme are named *inner end of middle ground* marks. The marks on shoals of small extent are named *isolated danger* marks.

Starboard hand marks are painted red, and surmounted by a topmark of conical shape; if necessary, they are numbered by even numbers commencing from seaward.

Port hand marks are painted black, and surmounted by a topmark of cylindrical shape; if necessary, they are numbered by uneven numbers commencing from seaward.

Outer end of middle ground marks are painted *white* and *black* in horizontal stripes, and surmounted by a topmark formed by two cones, bases together.

Inner end of middle ground marks are painted *white* and *red* in horizontal stripes, and surmounted by a topmark formed by two cones, points together.

Isolated danger marks are painted *red* and *black* in horizontal stripes, and surmounted by a topmark of spherical shape.

Wreck marks are painted *green*, and lights are placed according to circumstances.

Names or numbers on marks are painted in *white* letters or figures.

BELGIAN UNIFORM SYSTEM OF BUOYAGE.—A portion of the Western Schelde, included between Netherlands territory and the Rupel, is buoyed by the Belgium Government.

In the channels at the mouth of the river and along its course to Antwerp, can buoys, *white* on the starboard hand and *black* on the port, are used.

Red buoys with beacons are placed at the points where different channels lead up the river, and beacon buoys are placed at the elbows or turning points.

Large beacons of uniform construction, but distinguished from each other by their mountings, are placed in some of the channels near low-water mark; these are especially useful in winter when certain buoys are removed.

Vessels marking wrecks carry by day two *black* balls, and by night two bright lights horizontally, and visible one mile. Steam-vessels are to slacken speed, when approaching any of these vessels.

NETHERLANDS UNIFORM SYSTEM OF BUOYAGE.

—The Netherlands Government has given notice, dated 1st April, 1892, that the following Uniform System of Buoyage has been accepted, and will be carried out, on the coast of the Netherlands:—

The term “starboard hand” means that side which would be on the right hand going with the main stream of flood, or in entering a harbour, river, or estuary, from seaward; the term “port hand” means the left hand side, under the same circumstances.

Conical buoys are starboard hand buoys as thus defined, and are painted *red*.

Can or truncated buoys are port hand buoys as thus defined, and are painted *black*.

Spherical buoys, mark the ends of middle grounds, and are painted *black* and *red* in horizontal stripes. These buoys are always surmounted by top marks, other buoys only in special cases.

Buoys lying outside, and marking the approach to, seaward channels are of a special shape, and are painted *red* and *black* in vertical stripes.

The buoys marking the outer shoals in the North Sea remain as at present.

In the inner channels, where necessary, certain buoys will be replaced by spar buoys.

Wrecks are marked by conical or truncated buoys, painted *green*, according as the wreck lies on the starboard or port side of the fairway. Should the wreck be in mid-channel, it will be marked by a truncated buoy on one side, and a conical buoy on the other side, which buoys are to be treated as port or starboard hand buoys according to shape.

The top marks are as follows :—

- A diamond marks the outer or seaward side of a bank.
- A cone marks the inner side of a bank.
- A ball marks the starboard side of the fairway.
- A truncated cone marks the port side of the fairway.
- A cross indicates that the buoy may be passed on either side.
- The ball and truncated cone are also used as top marks for beacons.

The top marks are of the same colour as the buoys or beacons on which they are placed.

The buoys of sea channels will be numbered consecutively (beginning from seaward), and marked by the first letter of the name of the channel. The numbers and letters will be *white*. The buoyage of the river Ems will remain as at present.

This Uniform System of Buoyage will gradually be adopted, as regards the shape of the buoys and top marks, whilst the alteration in colour will only be made when all else has been changed in accordance with the new system. For this reason, it is necessary during the period of transition, that attention should be exclusively given to the colour (as has hitherto been the case), and not to the shape of the buoys ; the existing colours, *black* and *white*, remaining temporarily unaltered.

GERMAN UNIFORM SYSTEM OF BUOYAGE.—The following Uniform System of Buoyage was established in 1889.

The seaward entrances of channels, not marked by light vessels, beacons, or moles, have beacon buoys, of the same colour as the channel buoys, moored in such a position that the nearest channel buoys may be plainly seen from them.

The term *Starboard Hand* denotes that side of a channel which lies on the right hand of the mariner when entering from seaward ; and the term *Port Hand*, the left hand under the same circumstances.

Where a channel connects two parts of the sea, or two sheets of water separated by banks, the *Starboard Hand* is that side which lies on the right hand when entering from the westward. The term, from the westward is taken to include the whole of the western semicircle, from North (true), inclusive, to South (true) ; and the *Port Hand* that on the left.

Buoys surmounted by a topmark, Bell buoys, Gas buoys, or Automatic signal buoys, are called *Beacon*.

Buoys showing a portion of a cylinder, with the arched side uppermost above water, are called *Barrel*.

Beacons consisting of a group of piles are called “*d’Alben*.”

To face top of page 18.

Vessels placed to mark the position of wrecks on the Netherlands coast are distinguished as follows :—

AT NIGHT.—By three *fixed* lights shown from a yard, about 19 feet above the sea. A *red* light above a *white* light (about $2\frac{1}{2}$ feet apart) on the side that shipping may safely pass, and a *red* light on the other side. These lights should be visible in clear weather from a distance of one mile.

BY DAY.—Three black balls, similarly arranged.

When the lights are hoisted on the wreck itself, or the vessel placed to mark it is exactly over the wreck, the *red* light above the *white* light will alone be shown.

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Beacons consisting of single stakes or perches, and driven into the ground, are called *Perches*; these may be surmounted by branches or brooms.

Beacons consisting of young trees, with branches, or branches only, are called "*Pricken*."

Letters or numbers on channel buoys or beacons are painted *white*, and begin with the buoy or beacon furthest seaward; but channels of considerable length may be divided into sections, each with a separate series of letters or numbers.

Starboard Hand buoys are spar buoys, painted *red*; or where several channels are near each other, or the water is not deep enough for spar buoys, can buoys, painted *red*, may be used.

Port Hand buoys are conical buoys painted *black*.

Starboard Hand beacons are beacons with spars, painted *red*, or perches; Port Hand beacons are beacons without spars, painted *black*, or "*pricken*."

Mid-channel buoys, which may be passed on either side, are spherical buoys, painted *red* and *black*, in stripes.

The extremes of shoals extending from the shore, or of reefs in channels, are marked by beacons or beacon buoys, painted *red* and *black*, in stripes.

The extremes of middle grounds are marked by beacons or beacon buoys, painted *red* and *black*, in stripes, and are surmounted by a cross.

Shoals lying seaward of channels are marked by spar buoys, beacon buoys, or beacons. Should a shoal be so small that it can be marked by a single buoy or beacon, and passed on any side, such buoy or beacon is painted *black* and *white* in stripes, and surmounted by a drum.

Buoys and beacons, marking the edges of shoals seaward of channels, are painted *white*, and surmounted by two vertical equilateral triangles, arranged as follows: when on the northern edge of the shoal, the points of both triangles upwards; on the southern edge, points downwards; eastern edge, point of upper triangle upwards, point of lower triangle downwards; western edge, points towards each other.

The name of the shoal, either in full or abbreviated, is painted on the buoys and beacons marking it, in *black* letters; and buoys and beacons on the edges of shoals have the letters N., S., O. or W. painted on them in *black* letters, to correspond with the side of the shoal on which they are situated.

Wreck buoys are either can, conical, or barrel buoys, painted *green*, with the word *Wrack* (wreck) painted on them in *white*

letters. The distinguishing marks on wreck buoys are similar to those used for marking shoals seaward of channels.

Buoys marking the position of telegraph cables are spherical buoys painted *green*, with the word *Telegraf* or **T** painted on them in *white* letters. When shore beacons are used, the outer beacon is a triangle, and the inner beacon a rectangle.

Buoys marking the boundaries of quarantine stations are either can, conical, or barrel buoys, painted *yellow*.

Buoys marking target, mine, or torpedo grounds are barrel buoys, painted *yellow*, and surmounted by a small *red* flag.

Buoys and beacons for mooring purposes, or to define the boundaries of a roadstead, or used for surveying purposes, are so constructed in shape, colour, and top-marks as to prevent their being mistaken for any other buoys or beacons in the vicinity.

In winter, special buoys are substituted where endangered by ice.

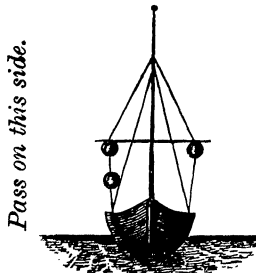
German wreck-marking vessels.—The German Government adopt the English system for marking and passing wreck-marking vessels.

When a wreck-marking vessel is used it shall, if possible, have its top sides coloured *green*, with the word “Wreck” in white letters thereon, and shall exhibit—

By day : Three balls on a yard 20 feet above the sea, two placed vertically at one end and one at the other, the single ball being on the side nearest to the wreck.

By night : Three *white fixed* lights similarly arranged, but not the ordinary riding light.

In narrow waters or in rivers or harbours, when a wreck-marking vessel is used, she shall carry a cross-yard on a mast, with two balls by day placed horizontally not less than 6 nor more than 12 feet apart, and two lights by night similarly placed. When a barge or open boat only is used, a flag or ball may be shown in the daytime.



DANISH UNIFORM SYSTEM OF BUOYAGE.—As the main channels in Danish waters principally trend in a northerly and southerly direction, while the narrow passages between the

islands have an easterly and westerly direction, the colours of the buoys are, as far as possible, arranged as follows:—

When coming from the north, or from the east, or entering a bay, *red* or *black* buoys are kept on the starboard hand, and *white* buoys on the port hand.

When coming from the south, or from the west, *white* buoys are kept to starboard, and *red* or *black* to port.

Those coloured *red* and *white* horizontally, denote middle grounds and may be passed on either side.

Green buoys indicate wrecks.

All buoys may have top-marks or beacons, such as staff and ball, or staff and broom, where especially required; if a broom is used, it is opened upwards unless otherwise mentioned.

In winter, spar buoys are substituted on account of the ice.

Danish wreck marking vessels.—The Danish Government adopt the English system for marking and passing wreck marking vessels. *See* page 20.

TIDAL SIGNALS.

FRENCH TIDAL SIGNALS.—The following system of tidal signals is now, with some variations, used at all the ports. The signals are made by balls and flags hoisted on a mast, on which a yard is crossed. The balls are *black*.

A ball hoisted at the intersection of the mast and yard denotes a least depth of 9 feet 10 inches (English) throughout the channel of the harbour.

Each ball hoisted on the mast beneath the first denotes an additional depth of $3\frac{1}{4}$ feet.

Each ball hoisted above the first denotes an additional depth of $6\frac{1}{2}$ feet.

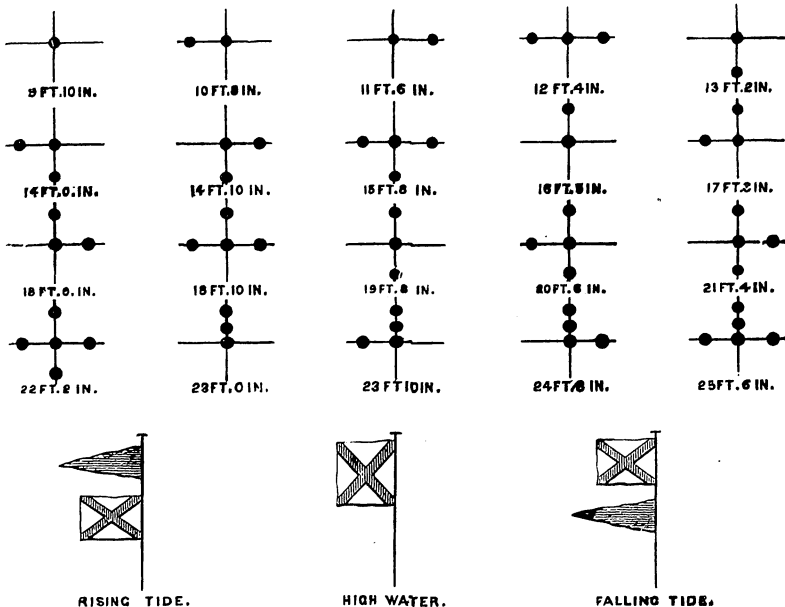
Each ball hoisted at the left yard-arm, looking from seaward, denotes an additional 10 inches.

Each ball hoisted at the right yard-arm denotes an additional 1 foot 8 inches.

To indicate the state of the tide, a *white* flag with a *black* cross is used; also, a *black* pennant. These are hoisted at the mast-head immediately there are $6\frac{1}{2}$ feet in the channel and lowered when the water has receded to the same level. During the flood, the pennant is above the flag; at high water and during the top of the tide, the pennant is hauled down; and, during the ebb, the pennant is hoisted below the flag. When the state of the sea is such as to prevent vessels entering the port, these signals are replaced by a *red* flag hoisted at the mast-head.

It should be remarked that the signals are not necessarily complete at all ports, but, so far as they are used, their significations are always the same. Thus, at some places the depths are shown only at every $3\frac{1}{4}$ feet, in which cases balls at the yard-arms are not required. At others, the depth of $6\frac{1}{2}$ feet, together with the state of the tide, is indicated by the flag and pennant, a ball being hoisted below them when there are 10 feet. In this latter case the mast has no yard.

FRENCH TIDAL SIGNALS.

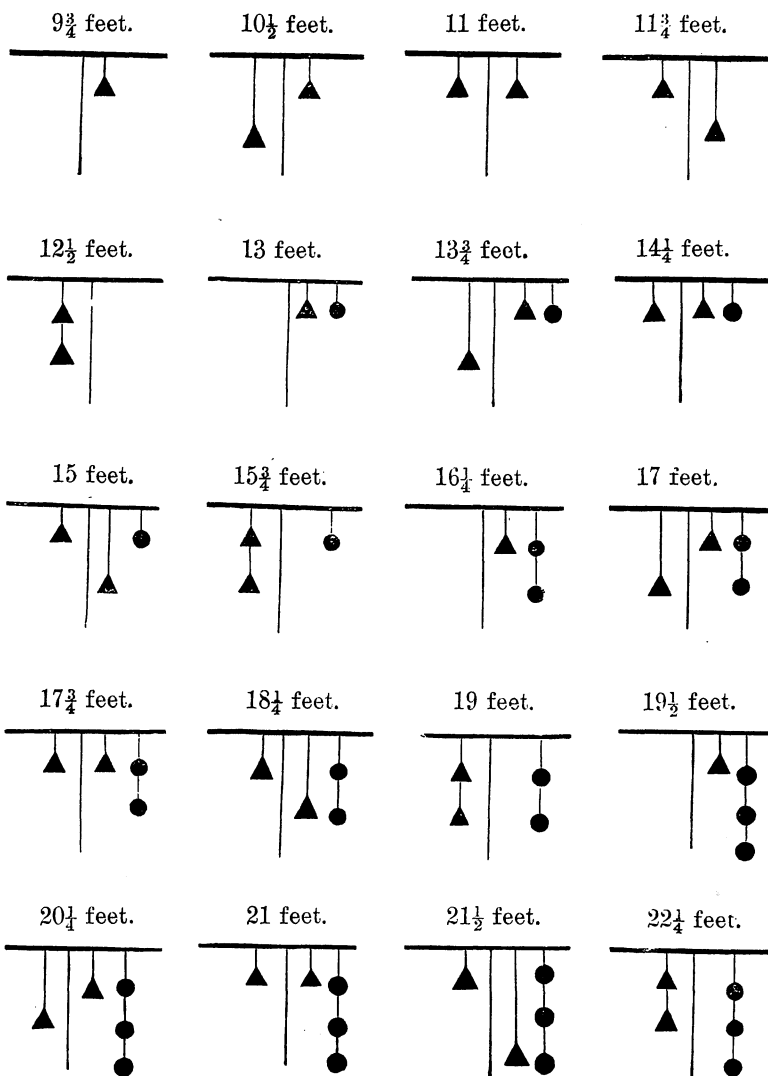


At **New Rotterdam** canal entrance, near the inner end of north pier.

At **Ymuiden**, from a mast situated on the south side of the entrance near the outer leading light.

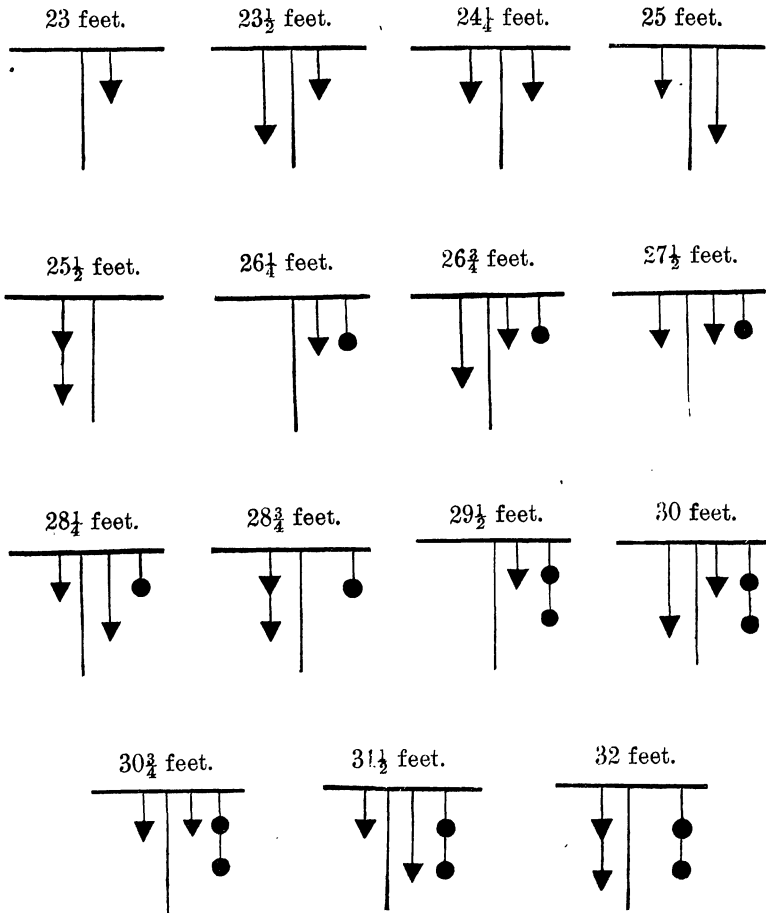
DAY SIGNALS—BALLS AND CONES.

(As seen from seaward.)



DAY SIGNALS—BALLS AND CONES—*continued*.

(As seen from seaward).



A *blue* flag indicates that there are 4 inches more water than shown by the signal.

A square *black* flag indicates that the channel is unsafe.

A *white* flag with blue cross indicates that it is high water.

A *blue* pennant indicates that it is low water.

Night tidal signals for the New Rotterdam canal are given on page 135. And those for Ymuiden on page 145.

DISTRESS and PILOTAGE SIGNALS.—The following signals have been adopted by the Governments of England, Germany, and Holland.

Distress signals.—In the daytime : (1.) A gun fired at intervals of about a minute ; or (2.) the distress signal “N.C.” of the International code ; or (3.) the distant signal, consisting of a square signal flag, with a ball or some similar object either above or below it.

By night : (1.) a gun fired at intervals of about a minute ; or (2.) flames produced by burning tar-barrels, oil casks, &c. ; or (3.) rockets or shells of any kind or colour discharged, one at a time at short interval. These signals must only be used by vessels when they are in distress or danger.

The under-mentioned rocket signals are established at the lighthouses on the Netherlands coast, for vessels seen in distress during the night.

1. Firing one rocket will signify, that the signal of distress from the vessel has been seen, or that the vessel in distress has been seen, from the lighthouse.
2. Firing two rockets, within one minute of each other, will signify, that wind and weather permitting, assistance will be rendered the vessel.

Pilotage signals.—In the daytime :—(1.) the Pilotage flag hoisted at the fore, having a white border round it one-fifth the breadth of the flag ; or (2.) the Pilotage signal “P.T.” of the International code.

By night :—(1.) Blue light every 15 minutes ; or (2.) a bright white light shown at intervals immediately above the bulwarks, and visible each time about a minute. These signals must only be used by vessels when pilots are required on board them.

Danish pilot signals.—When desiring to call a pilot, make the following signals, either separately or together.

By day :—(1) The Jack or other national flag usually worn by merchant vessels, with a white border one-fifth the breadth of the flag, hoisted at the fore.

- (2) The signal P.T. (Want a pilot), of the International code of signals.

By night :—(1) A Blue light, shown every 15 minutes.

- (2) A *white flashing* light, shown at short or frequent intervals above the bulwarks for about a minute at a time.

GERMAN SIGNAL STATIONS.—The following signal stations are established on the North sea coast of Germany, in communicating with which the International code of signals should be used.

Name of Station.	Latitude N. (approximate).	Longitude E. (approximate).	Remarks.
Ellenbogen - -	55 3	8 24	In connection with the German telegraph system.
Rothe Klif - -	54 57	8 20	
Amrum - -	54 39	8 21	
Eider outer light-vessel.	54 16	8 17	
Neuwerk - -	53 55	8 30	In connection with the German telegraph system.
Cuxhaven - -	53 52	8 42	
Rother sand light-house.	53 51	8 5	In connection with the German telegraph system.
Hohe Weg - -	55 43	8 15	
Wangeroog - -	53 47	7 54	Do.
Norderney - -	53 43	7 13	Signals shown from lighthouse.
Borkum - -	53 35	6 40	In connection with the German telegraph system.

German dredger signals.—The following signals are shown by the steam dredgers employed in German coastal waters (with the exception of those moored in the lower Weser), to indicate the side on which vessels may pass. By day a *red* ball; by night, two lights placed vertically—upper light *red*, lower *white*.

The signals to indicate the side of a dredger on which vessels may not pass, or the special signals to be shown should a channel be completely closed by a dredger, are in every case decided by the local authorities.

German distress and pilot signals.—*See* page 25.

NETHERLANDS TELEGRAPH and RESCUE STATIONS.—The following stations on the coasts are connected with the nearest telegraph station either by telegraph or by telephone.

At stations marked thus †, a look-out is maintained by day and night.

At stations marked "Signal station," messages communicated from ships by means of the International code, will be received and forwarded to their destination :—

CONNECTED PLACES.	PARTICULARS.
Nieuwe Sluis.	
Breskens.	
Walcheren island :	
Flushing (Vlissingen), Pilot look-out...	Life-boat, in shed on mole of outer harbour.
Zouteland... ..	Life-boat.
Westkapelle, Director's house	Life-boat.
† „ lighthouse on Westkapel-schen dike.	Semaphore.
Schouwen island :	
†West Schouwen lighthouse	Semaphore.
Haamstede, Burgomaster's house.	
Burgsluis	Life-boat, in shed near the small harbour.
†Noord Schouwen, lightkeeper's house.	
Scharendike.	
Brouwershaven	Life-boat, in shed near the harbour.
Goeree island :	
Ouddorp, Director's house.	
†Goeree lighthouse	Semaphore.
„ Director's house	Life-boat, in shed near iron beacon.
Voorne island :	
Hellevoetsluis... ..	Life-boat, on mole in front of Marine sluis.
Brielle, <i>Hofland</i> house	Life-boat, in the harbour near torpedo flotilla.
Heenvliet.	
South Holland :	
Maas Sluis	Life-boat, in the harbour, near Uitenbogaard wharf.

CONNECTED PLACES.				PARTICULARS.
†Hook of Holland, Signal staff ...	...	...	...	Semaphore, special tidal signals.
„ „ Pilot station	...	...	...	Life-boat, in shed near the Berghaven.
Vlugtenberg ... ..	...	...	...	Life-boat, close to Delfland shed, near Slaper dike.
Gravesande, Burgomaster's house.				
Monster, Burgomaster's house.				
Ter Heide ... ..	...	...	...	Life-boat, in shed near the shore, close to <i>Slag</i> .
Loods-duinen, <i>Oorschot</i> house...	...	...	...	Life-boat, near look-out post on sand-hills.
Scheveningen ... ..	...	...	...	Life-boat, in the basin near canal.
„ ... ..	...	...	...	During bathing season, the bath house is also connected.
†Scheveningen, lighthouse ...	...	...	...	Semaphore.
Katwijk aan Zee, Director's house	...	...	...	Life-boat, in basin near the Oude-kerk.
Noordwijk binnen.				
Noordwijk aan Zee ... ..	...	...	...	Life-boat, in basin.
North Holland :				
†Ymuiden, Signal staff ... ..	...	...	...	Semaphore, special tide signals.
„ Pilot station ... ..	...	...	...	Two life-boats, at inner ends of moles.
Wijk aan Zee, Life-boat station	...	...	...	Life-boat in basin. This place is only connected with Ymuiden after the bathing season.
Egmond aan Zee, Director's house				
† „ „ lighthouse ... ..	...	...	...	Signal station.
Petten ... ..	...	...	...	Life-boat, in basin.
Callentsoog ... ..	...	...	...	Life-boat, on sand hill.
Huisduinen ... ..	...	...	...	Life-boat, on sand hill.
†Kijkduin lighthouse ... ..	...	...	...	Special signal station.
Nieuwe diep, Harbour office ...	...	...	...	Life-boat near the Marine sluis.

CONNECTED PLACES.	PARTICULARS.
Texel island :	
Texel (den Berg).	
Koog	Life-boat, near the shore.
Cocksdoorp.	
† Eierland lighthouse	Semaphore, telegraph station in lighthouse and life-boat on Grooten Scochter.
Vlieland island :	
Vlieland, Director's house	Life-boat, in basin.
† „ lighthouse	Signal station.
„ Post office	Life-boat near.
Terschelling island :	
Terschelling	Life-boat, on western shore, northward of West Terschelling.
† Terschelling lighthouse... ..	Signal station.
Midsland	Life-boat, northward of,
Oostereind	Life-boat, in basin.
Ameland island :	
† Hollum lighthouse	Signal station. Life-boat, in basin.
Nes townhall	Life-boat, in basin.
Schiermonnikoog :	
Schiermonnikoog, Director's house ...	Life-boat near Oosterburen.
† „ north lighthouse ...	Signal station.
Friesland :	
Harlingen, Director's house	Life-boat.
Moddergat	Life-boat, near Paezens.
Oostmahorn.	
Groningen :	
Delfzyl.	
Life-boats are also established at the following places, which are not connected with the Coast Guard service :—	
Zandvoort, North Holland.	
Den Hoorn, on Texel.	

DANISH RESCUE STATIONS.—The following is a list of the rescue stations on the western and northern coasts of Jutland. Nearly all these stations are connected by telephone.

Name of place.	Latitude N.	Longitude E.	Remarks.
Sönderho - -	55 19	8 28	Lifeboat.
Rindby - - -	55 26½	8 24½	Lifeboat and rocket apparatus.
Svenske Knolde -	55 29	8 16	Lifeboat.
Blaavand - - -	55 34	8 5	Lifeboat and rocket apparatus.
Veirs - - -	55 37	8 7	Do.
Hennestrand -	55 43	8 10½	Rocket apparatus.
Nyminde Gab -	55 48	8 11½	Lifeboat and rocket apparatus.
Bjerregaard - -	55 53	8 10	Rocket apparatus.
Haurvig - - -	55 55½	8 10	Lifeboat and rocket apparatus.
Sönder Lyngvig -	56 2½	8 6	Do.
Sondervig - - -	56 8	8 6	Do.
Vødersø - - -	56 16½	8 7	Do.
Fjand - - -	56 20½	8 7	Rocket apparatus.
Thorsminde - -	56 23	8 6½	Lifeboat and rocket apparatus.
Tuskicer - - -	56 29	8 7	Do.
Ferring - - -	56 33	8 7	Rocket apparatus.
Lilore - - -	56 35	8 7½	Lifeboat and rocket apparatus.
Flyvholm - - -	56 37½	8 9	Do.
Thybo Rön - - -	56 42	8 12	Do.
Vester Agger -	56 48	8 14	Lifeboat.
Hedegaarde - -	56 51½	8 17	Rocket apparatus.
Lyngby - - -	56 52½	8 18	Do.
N. Vorupøre - -	56 57	8 22	Lifeboat and rocket apparatus.
Klitmøller - - -	57 3	8 30½	Do.
Hanstholm - - -	57 7½	8 38	Do.
Vixø - - -	57 6	8 46	Rocket apparatus.
Lildstrand - - -	57 10	9 0	Lifeboat and rocket apparatus.
Thorupstrand -	57 8	9 17	Do.

Name of place.	Latitude N.	Longitude E	Remarks.
Slettestrand - -	57 9½	9 25	Lifeboat and rocket apparatus.
Rodhus - -	57 12	9 30	Lifeboat.
Blokhus - -	57 15½	9 35	Lifeboat and rocket apparatus.
Lokken- - -	57 22½	9 43	Do.
Longstrup - -	57 28	9 48	Do.
Hirtshals - -	57 35	9 57	Do.
Uggerby - -	57 36	10 11	Lifeboat.

Between Uggerby and the Skaw (about 15 miles) there are 7 rescue stations, 4 of which have lifeboats and rocket apparatus, and 3 have lifeboats only.

TELEGRAPH CABLES.—Several telegraph cables are laid in the bed of the North sea ; a list of the landing places of these may be useful :—

1. From Shakespear's cliff near Dover to Sangatte, 3 miles west of Calais.
2. From St. Margarets bay near the South Foreland to cape Gris Nez.
3. From St. Margarets (as above) to La Panne in Belgium.
4. From Broadstairs near Ramsgate to Middelkerke near Ostend.
5. From Lowestoftness to Zandvoort in Holland.
6. From Covehitheness to Zandvoort in Holland.
7. From Lowestoft to Norderney in Germany.
8. From Lowestoft to Borkum in Germany.
9. From Valentia in Ireland to Greetsiel in Germany, *viâ* Dover strait.
10. Heligoland to Amrum lighthouse ; and also, to Wilhelms-haven and Neuwerk island near Cuxhaven, and to Shillig-horn in Jade river, eastward of Wangeroog.
11. From Sylt island in Germany to Arendal in Norway.
12. From Newbiggin to Hirtshals point in Denmark.
13. From Newbiggin to Sondervig in Denmark.
14. From Newbiggin to Arendal in Norway.
15. From Newbiggin to Marstrand in Sweden.
16. From Peterhead to Ekersund in Norway.
17. From Oye in France to Nordby in Fano island (Denmark).
18. From Hirtshals point in Denmark to Arendal in Norway.

STEAMSHIP ROUTES.—Those bound from Dover strait to the Baltic or the reverse must bear in mind the constant stream of traffic across their course up or down the North sea, between the British coast and that of Holland and Germany. The number of sunken wrecks shown on the charts, as lying in the fairway in from 10 to 15 fathoms, should alone urge upon seamen, the need of the closest vigilance.

Opportunity is here taken to again (*see* page 2) call the attention of seamen to the absolute necessity for the *use of the lead* when nearing or passing along the coast of Holland, in thick weather.

Apart from the tidal streams, the currents are uncertain both in direction and strength, and being sensibly affected by the winds, may at times set directly towards the shore, the safety of vessels, therefore, can in thick weather only be assured by timely *use of the lead*, and seamen should be prepared, on getting into shallow water, to anchor or stand off the land as circumstances may require. Reference to the charts shows that by keeping outside the depth of 12 fathoms a vessel would in most cases be in safety, but this does not apply to the approaches to the Texel, where the water quickly shoals from 10 fathoms to the outlying sands. *See* page 160.

Those from the Baltic bound for the Humber or the Thames, should endeavour to make their landfall respectively at Flamborough head and Lowestoft where the shores are comparatively free from outlying banks.

Between the Thames and Schelde by steamships.—Taking departure from the Tongue light-vessel steer (allowing for tide) to pass southward of Fairy bank and the light-vessel marking the southern extreme of the West Hinder, avoid the shoal patch at the eastern part of East Dyck bank, and steer for Wandelaar light-vessel, pass southward of it, and up Wielingen channel into the Schelde. The opposite courses are followed on the return route. The distance from the Nore to Flushing is about 110 miles.

Those from Harwich take their departure from the Sunk light-vessel, thence northward of Long Sand light-vessel, and southward of Galloper light-vessel. From thence steer to pass southward of North Hinder light-vessel, and northward of West Hinder bank to Wandelaar light-vessel. When there is much sea on, do not pass over the East Hinder, as there, it is very heavy, but after passing the North Hinder, steer southward clear of the East Hinder before shaping course for the Wandelaar.

Between the Thames and Rotterdam by steamships.—Taking departure from the Nore, the route by the southern channels

to the mouth of the river is a little shorter than by the Swin, and on the return route the North Foreland is decidedly the better land-fall, besides being more free of outlying shoals. Nearly all the steamship traffic from the North sea to Rotterdam is through the New Rotterdam canal (Nieuwe Waterweg), 8 miles off which is moored the Maas light-vessel, and it is advisable to make the light before closing the entrance to the canal. The packets from Harwich pass out northward of the Shipwash and Outer Gabbard, and then straight across to the Maas light-vessel; on this route care must be taken to avoid the position of the sunken wrecks mentioned on page 15. The distance from the Nore to the Hook of Holland is about 130 miles.

Between the Thames and the Jade, Weser, or Elbe by steamships.—The departure being taken from Orfordness, a course E. by N. $\frac{3}{4}$ N. made good for 155 miles will lead 15 miles northward of the Texel, which distance from the shore should be maintained until the outer light-vessels are recognised and then steered for.

Between the Humber and the Elbe by steamships.—The steamships from the Humber for the Elbe pass northward of the Outer Dowsing, and steer for the light-vessel on Borkum flat; strangers should make Heligoland before closing the Elbe.

When returning, and the winds are strong from the north-west quarter, it is usual to pass southward of the Leman and Ower banks, and from thence to the Humber between the Dudgeon and Outer Dowsing.

Between the Thames and the Skaw by steamships.—No detailed directions are necessary for this route in a steam-vessel; it may be useful perhaps to draw attention to the set of the currents on the coasts of Jutland (*see* p. 12), and to mention that it is not prudent to pass within a distance of 10 miles from Hirtshals in a large or deep draughted ship.

SAILING ROUTES.—From the Thames to the Skaw.—As the banks in the North sea occupy large portions of ground, somewhat shoaler in general than the parts surrounding them, soundings, when carefully taken, tend materially to assist in verifying the vessel's position. When navigating from port to port, the seaman will have to consider the force and direction of the wind, the tides, and his proximity to the land. Those from the Thames bound for the Skagerrak may pass between the Shipwash and Galloper sands, or, if from the Downs, between the latter and Kentish Knock, and

gain the open sea either eastward or westward of the Gabbard sands, according to circumstances.

Those eastward of the Goodwin, after passing the North Sand head light-vessel at a distance of about 3 miles, and nearly midway between it and the Falls Tail (*see* North Sea Pilot, Part III.), should steer to pass between the Drill stone and the Falls head, about 5 miles eastward of the Kentish Knock light-vessel, and 3 miles westward of that of the Galloper. The depths of water in this track will be from 27 to 17 fathoms, and the direction of the tidal stream nearly in the same line. Those whose draught will admit of crossing the shoal parts of the Falls may, with attention to the lead, skirt this ridge close up to the Galloper, as it is steep-to on either side; but, if of heavy burden, they should be careful to avoid the shoal parts.

When working to the northward, eastward of the Falls, be careful to avoid the Sandettié (*see* page 41), on which are strong rippings, and in fresh breezes a heavy sea, which breaks on the shoalest part. Further northward do not stand eastward of a line joining the Fairy and North Hinder banks; and it will be prudent for those of large draught to keep to the northward of the *red* buoy (not always to be depended on) to avoid the shoal part of the latter bank. At about 4 miles eastward of the Galloper steer to cross the parallel of 53° N., and about midway between Brown ridge and Smith knoll (*see* North Sea Pilot, Part III.).

As the depths over Brown ridge and those eastward of it are from 11 to 15 fathoms, with deeper water between and immediately eastward of them, by attention to the lead they form an excellent guide when in this vicinity.

Cross the parallel of 54° N. eastward of the Outer Silver pit, at the south end of the Dogger bank.

About 20 miles northward of the north-east end of the Dogger bank, on the parallel of 56° N., and about 120 miles from the coast of Jutland, is the 30-fathoms contour line. In all cases it is better to keep well to the westward, to counteract the effect of any easterly current (*see* page 12) as the coast of Jutland is low and not always seen until close to it. If necessary, it may be avoided by skirting the 30-fathoms line, which curves round Hantsholm lighthouse at a distance of nearly 20 miles. From Bovbjerg (page 242) to the Skaw, the land when seen may be recognised, and soundings obtained.

The coast of Norway is bold, rocky, and the water deep. The Naze is a bluffish red land; over it, a little inland, is the high land of Spangereid, in the spring generally capped with snow, and which in clear weather may be seen from a distance of 36 miles from the coast.

Homeward route.—Sailing vessels bound from the Skagerrak to the Thames should steer well to the northward, keep the Skagerrak open, and avoid the coast of Jutland. When working, stand towards the coast of Norway, and not southward of the edge of the bank of soundings, until as far westward as the Naze, as the current near this part of the coast of Norway sets to the westward, but does not extend far from the land. After passing the Naze the seaman will soon perceive the effects of the current, and must act according to the direction and force of the wind. Be careful not to stand southward of Bovbjerg with a north-west wind, in order to avoid the Horn reefs (page 236). In winter, seamen are strongly recommended to make the coast of Yorkshire somewhere about Flamborough head, thus avoiding the Yarmouth sands, and having a good departure to clear the Leman and Ower.

As the 30-fathoms contour line trends in a W. by S. direction from the entrance of the Skagerrak almost up to Flamborough head, it is an excellent guide to those taking this route. By not going to the southward into a less depth, or to the northward into a greater depth. Flamborough head will be made, where an explosive rocket is fired every ten minutes during thick weather. Those in vessels of heavy draught, however, commonly steer outside the Leman and Ower light-vessel, and make the land between Lowestoft and Orfordness, where the soundings are regular, and the shore can be approached to a prudent distance. When approaching the coast of Norfolk, should soundings be obtained on Swarte or Broken banks, they will indicate proximity to the Leman and Ower, when a sight of the light-vessel stationed on the latter bank may be obtained; and further to the south-west in 24 to 26 fathoms water, be careful when standing to the westward, until to the southward of Smith knoll.

Sailing across the North sea.—When bound across the North sea, the routes given for steamships should be followed so far as the winds will admit of. But during northerly winds and thick weather use the utmost caution in rounding the Texel and the low islands eastward of it (*see* page 160), on no account coming into less than 12 fathoms, and also pass outside Borkum flat in about 18 fathoms soft muddy bottom; and it will be well to 'heave to' at about 22 miles from Heligoland, which should be sighted before closing the Elbe.

CHAPTER II.

NORTH SEA, SOUTHERN PORTION.—CAPE GRIS NEZ TO
DUNKERQUE.

VARIATION, $15\frac{1}{2}^{\circ}$ WEST IN 1892.
Decreasing 8' annually.

OUTLYING BANKS IN THE SOUTHERN PART OF THE NORTH SEA.—The approach to the low and dangerous coast between Calais and the river Schelde is obstructed by numerous banks of grey and black sand, which extend 15 miles from the shore on the meridian of Calais, and 42 miles in a north-easterly direction from Dunkerque. They are all long and narrow, and converge in direction towards Dover strait. Their shoalest spots may be touched upon by vessels of almost any draught, and the eddies they occasion cause a hollow sea which breaks on them when it blows hard. Those furthest from the land lie on the eastern side of the 20-fathoms line of soundings, which, in the southern part of the North sea, is the eastern limit of the deep known as the Deep-soundings channel, which begins in Dover strait and ends at about lat. $53^{\circ} 20' N$.

The banks are all steep-to on their in-shore edge and extend with a gentle slope towards the offing, and, as they rise from the submarine bank of sand, gravel, and broken shells which joins the shore, and on which there are everywhere less than 20 fathoms, the simple precaution of not going into less than that depth ensures keeping outside all these banks. The lights at cape Gris Nez and Calais are in a good position to point out at night their western limit; the *electric flashing* light at Dunkerque, seen in clear weather 20 miles, gives notice of approach to the greater part of them, and the navigation is still further facilitated by the two light-vessels

moored within the Hinder banks, by that north-eastward of the Ruytingen, and by others more in-shore.

The dangers of the in-shore navigation can only be avoided by placing the vessel in charge of a good pilot, for the banks are *all so liable to changes in their formation that no description of them can be considered permanently reliable*; generally speaking, none of the banks should be approached except a vessel is bound for one of the harbours on the coast.

The banks are divided into two groups, those nearest the shore, eleven in number, being named the Dunkerque banks (also, as the Flemish banks); others, six in number, lying some distance from the coast and northward of the Dunkerque banks, were but little known until surveyed by the late Captain W. Hewett, R.N., in H.M.S. *Fairy* between 1831–1840; they are, the Fairy, North Hinder, West Hinder, East Hinder, and Bligh banks, and Thornton ridge. These latter being the outermost are first described.

OUTER BANKS.—These banks are dangerous, not only from their shallowness and their being so liable to change in form that anything but the *latest* charts may be very misleading, but also from their being so great a distance from the shore and directly in the route of vessels bound for the Schelde.*

Caution.—See at page 13 as to the slight rise of tide on these banks.

Fairy bank, a high sandy ridge with from $3\frac{3}{4}$ to 9 fathoms, water, is on the eastern side of the Deep-soundings channel, and the channel between it and West Hinder is $2\frac{3}{4}$ miles wide. From its southern end in 8 fathoms, Dunkerque lighthouse bears S. $\frac{1}{2}$ W. westerly, 18 miles, and West Hinder light-vessel E. $\frac{1}{4}$ S., distant $6\frac{1}{2}$ miles. From thence, it extends N.E. easterly for $9\frac{1}{2}$ miles, its greatest breadth not exceeding 8 cables.

There are two flats on this bank; that near the middle, with less than 5 fathoms water, is $2\frac{1}{2}$ miles long, and, from its shoalest spot of $3\frac{3}{4}$ fathoms, Dunkerque lighthouse bears S. by W. $\frac{1}{4}$ W., distant 22 miles. The other flat is near the northern end of the bank. Dunkerque light may be seen in clear weather from the southern end of Fairy bank.

See Admiralty charts:—North sea, Nos. 2,339 and 2,182a; Dover and Calais to Orfordness and Scheveningen, No. 1,406; Calais to river Schelde, No. 1,872.

A shoal about 8 miles in length, with from $6\frac{1}{2}$ to 9 fathoms water, lies 2 miles westward of and nearly parallel with Fairy bank.

North Hinder, a dangerous sand-bank, situated like Fairy bank on the eastern side of Deep-soundings channel, is 7 miles long N.E. by N. and S.W. by S., and from 5 to 8 cables wide, the general depth being from 6 to 9 fathoms; but, on its southern part, a narrow flat with only 4 and 5 fathoms extends $2\frac{1}{2}$ miles southward from about the middle of the bank, and is steep-to on its eastern side. From the northern end of the bank Galloper light-vessel bears W. by N. $\frac{1}{4}$ N., distant 24 miles.

Between North Hinder and Fairy bank, are three flats, of which two, with from 8 to 10 fathoms water, occupy a space 3 miles in length midway between the banks; the third, with 9 fathoms, lies 2 miles eastward of the northern end of Fairy bank.

LIGHT-VESSEL.—North Hinder light-vessel is moored in 20 fathoms, on the eastern side of the bank; and exhibits from the mainmast-head, at 39 feet above the sea, a *flashing white* light at intervals of *ten seconds*, visible in clear weather 11 miles.

The vessel has two masts, is coloured *red*, and has the name *Noord-Hinder* on sides. The day mark is a *red* ball at the mainmast head.

Note.—If the apparatus of the light is out of order, a *fixed white* light will be exhibited in lieu of the *flashing* light, and a *flare* light will be shown *every ten minutes* just above the bulwarks. If the light-vessel is out of position, neither the *flashing* light nor the usual riding-light will be shown, but *red* lights will be exhibited at bow and stern.

Fog signal.—The fog signal is a bell and a horn; the bell is sounded *every ten minutes*, preceded and followed by blasts on the horn.

Buoy.—A *red* buoy with the name *Hinder* in *white* letters is moored in 6 fathoms at the northern end of the shoal flat of North Hinder, with the light-vessel bearing S. $\frac{1}{4}$ E., distant 2 miles. Vessels of deep draught should keep northward of the buoy if crossing North Hinder. The buoy being in its correct position cannot be depended on.

Tidal streams.—The direction and rate of the tidal streams at North Hinder light-vessel are as follows :—

TIDES AT DOVER.		TIDES AT NORTH HINDER LIGHT-VESSEL.	
5 hrs. before high water ...	West turning to S.W.	$\frac{1}{4}$ to $\frac{1}{2}$	knots.
4 " " 	S.W.	$\frac{1}{2}$ to 1	"
3 " " 	S.W. by S.	1 to $1\frac{3}{4}$	"
2 " " 	S.S.W.	1 to $1\frac{1}{2}$	"
1 " " 	S.S.W.	$\frac{3}{4}$ to $1\frac{1}{4}$	"
High water ... Turning from South to East		$\frac{1}{4}$ to $\frac{1}{2}$	"
1 hr. after high water	Turning from East to N.E.	$\frac{1}{4}$ to $\frac{1}{2}$	"
2 hrs. " " 	N.E.	$\frac{3}{4}$ to $1\frac{1}{4}$	"
3 " " 	N.E. by N.	1 to $1\frac{3}{4}$	"
4 " " 	N.N.E.	1 to $1\frac{1}{2}$	"
5 " " 	N.N.E.	$\frac{3}{4}$ to 1	"
6 " " 	North turning to West	$\frac{1}{4}$ to $\frac{1}{2}$	"

West Hinder, a sand-bank 15 miles long within the 10-fathoms line, and from 7 cables to $1\frac{1}{4}$ miles wide, lies eastward of Fairy bank and southward of North Hinder. Its southern end in 9 fathoms lies with Dunkerque bearing S.S.W., distant $18\frac{1}{2}$ miles; from thence, the bank trends N.E. $\frac{1}{4}$ E. for $8\frac{1}{2}$ miles and then N.N.E. $\frac{3}{4}$ E. for $6\frac{1}{2}$ miles to its northern end, which is $1\frac{1}{2}$ miles S.S.E. of the southern end of North Hinder. A flat occupies nearly the whole length of the bank and forms a continuous crest on which the depths are from $2\frac{3}{4}$ to $4\frac{1}{2}$ fathoms. By daylight, the West Hinder may generally be known by the tide ripples over it; but the lead should be kept carefully hove when approaching this or any of the Flemish banks.

The only passage practicable for large vessels bound to Flushing from the westward and intending to enter the Schelde by the Wielingen channel, is between the Outer Ruytingen, Bergues, and East Dyck on the one side; and, the Fairy and West Hinder on the other. See page 32.

When in-shore of the West Hinder, by not bringing Ostende lighthouse eastward of S.E. $\frac{1}{2}$ S., a vessel keeps north-eastward of all the banks between East Dyck and Middelkerke bank, which latter is the most western of the Ostende banks. West Hinder light-vessel also affords a good mark for clearing them, but constant attention should be paid to the lead.

LIGHT-VESSEL.—Near the southern end of West Hinder bank, and on its eastern side, in 17 fathoms, is moored a light-vessel which

exhibits at 40 feet above the sea a *group flashing* light visible in clear weather 12 miles, and showing two *white flashes* and one *red flash* every *half minute*.

The vessel is *black* with a *red* streak, with the name *West Hinder* on sides, and a conical framework at the mast-head.

Note.—Should the flashing apparatus be out of order, it will be replaced by two *fixed* lights, vertical; the upper *red*, the lower *white*, and a *white* flare light will be shown every *ten minutes*. Should the light-vessel drift from her station, the *flashing* light will be replaced by *three fixed* lights, vertical, the centre light *red*, the other two *white*; by day, in this latter case, a *red* flag will be hoisted at the mainmast-head. Should the light-vessel require assistance; by day, the flags N.C. of the International Code will be shown; by night, in addition to the distinguishing and anchor light, a *white* light will be shown at the taffrail and a *red* rocket will be fired every *fifteen minutes*.

Fog signal.—A siren is sounded, giving a prolonged blast at *two minute* intervals. Should the siren be out of order, the signal will be a bell sounded repeatedly at *two minute* intervals.

East Hinder, a sand-bank 11 miles long N.E. by N. and S.W. by S., within a depth of 10 fathoms, and 6 or 7 cables wide, lies eastward of the West and North Hinder; it has three flats, with from $3\frac{3}{4}$ to 5 fathoms on them and 6 or 7 fathoms between them, which occupy $8\frac{1}{4}$ miles of its extent. The bank is steep-to on both sides and separated from North Hinder by a channel 3 miles wide with from 16 to 19 fathoms; and, from West Hinder, by a channel $1\frac{1}{4}$ miles wide with from 15 to 19 fathoms. The northern end of the bank, in 9 fathoms, lies with North Hinder light-vessel bearing W.N.W., distant 5 miles. Its central shoal spot of $3\frac{3}{4}$ fathoms lies with North Hinder light-vessel bearing N.W. by W. $\frac{3}{4}$ W., distant 3 miles.

About midway between the southern end of East Hinder and the East Dyck, there is a narrow shoal $4\frac{1}{2}$ miles long with from 5 to 8 fathoms; it lies $1\frac{1}{2}$ miles eastward of West Hinder and its southern extreme is 2 miles northward of the northern end of East Dyck.

Bligh bank, of sand, is $10\frac{1}{2}$ miles long, from 5 cables to $1\frac{1}{4}$ miles wide, and lies about 3 miles eastward of and nearly parallel with East Hinder. Its northern end in 10 fathoms is in lat. $51^{\circ} 41\frac{1}{2}'$ N., long. $2^{\circ} 48' 45''$ E.

This bank is steep-to and has irregular depths of from $4\frac{3}{4}$ to 9 fathoms. About 3 miles from its southern end, a flat, $1\frac{1}{2}$ miles

long with $4\frac{3}{4}$ fathoms, rises abruptly from soundings of from 14 to 18 fathoms. There is also a 5-fathoms patch near the northern end of the bank.

Another patch, with 9 fathoms water, lies $1\frac{1}{2}$ miles northward of Bligh bank.

Thornton ridge.—Within a depth of 9 fathoms, this sand-bank is 13 miles long E. by N. $\frac{1}{2}$ N. and W. by S. $\frac{1}{2}$ S. with a mean but very varied breadth of $1\frac{1}{2}$ miles; it rises from soundings of from 12 to 17 fathoms, about 15 miles from the coast of Belgium. A flat, $2\frac{3}{4}$ miles long and half a mile wide, with from 2 to 3 fathoms, lies towards the eastern end of the ridge; the shoalest spot of 2 fathoms lies with Ostende lighthouse bearing S.S.W., distant 19 miles. The general depth on the other parts of the ridge is from 6 to 9 fathoms. The land in the neighbourhood of West Kapelle, and the lights of West Kapelle and of Ostende, may be seen from this ridge in clear weather.

The western end of Thornton ridge lies 3 miles S.S.E. from the South extreme of Bligh bank, and the space between is the least dangerous channel for large vessels to pass between the banks when bound northward from Dunkerque with south-westerly winds.

Buoy.—A *red and white chequered* buoy with, at night, a *quick flashing* gas light, visible 5 miles, is moored in 6 fathoms a short distance north-eastward of the shoal flat; from it, the Wandelaar light-vessel bears S. by W. distant $12\frac{1}{4}$ miles.

DUNKERQUE BANKS (also called the Flemish banks), eleven in number, extend 15 miles from the coast between the meridian of Calais and the frontier of Belgium. Their names are, the Sandettié, Outer Ruytingen, Inner Ruytingen, Bergues, Dyck (the north-eastern part of which is called the Clif d'Islande or East Clif), Inner Ratel, Outer Ratel, Haut fond de Gravelines, Breedt, Smal, and the bank bounding Dunkerque road to the northward, of which different parts are named Snouw, Braeck, Hils, and Traepegeer.*

Sandettié, in Flemish the Zand-detié, called also by local French mariners the Ourting, is the outer and westernmost of the Dunkerque banks; it is $12\frac{1}{2}$ miles long E. by N. $\frac{1}{2}$ N. and W. by S. $\frac{1}{2}$ S., its breadth varying from 4 cables to one mile. Its southern and eastern edges are steep-to, having from 19 to 20 fathoms at less

* See Admiralty chart :—Calais to the river Schelde, No. 1,872.

than half a cable from the southern edge, but its slope is more gradual towards the North-west and this side may be easily avoided by using the lead.

There are two shallow flats on this bank over which it is dangerous to pass in bad weather. The eastern flat, with only 21 feet, lies with Dunkerque lighthouse bearing S.E. by S. distant $18\frac{1}{2}$ miles, and, the centre of the western flat, on which there are only 20 feet, lies $3\frac{1}{2}$ miles W. by S. from that of the eastern flat. Besides these flats, other heaps of sand, with from 21 to 25 feet, extend $1\frac{1}{2}$ miles in a W. by S. direction from the western flat, but, on other parts of the bank, the depths vary from 31 to 46 feet.

The Sandettié, rising suddenly from comparatively deep water, causes strong ripplings, and, with a fresh breeze, the sea is heavy around it and breaks on the shoal flats.

From the south-western end of the bank, which is steep-to, in 8 or 9 fathoms, the following lights may be seen in clear weather :—Cape Gris Nez 20 miles S.W. $\frac{1}{4}$ S. ; Calais $12\frac{1}{2}$ miles S. by W. ; Gravelines 15 miles S.S.E. $\frac{3}{4}$ E. ; and, South Foreland 16 miles W. by N.

In the daytime, in clear weather, the summit of mont Couple may be recognised bearing S.S.W. $\frac{1}{2}$ W. nearly 19 miles ; also, the South Foreland and the white cliffs near Dover.

Outer Ruytingen, midway between the coast of France and the Sandettié, is separated from the latter by a channel from 5 to 6 miles wide, with soundings of from 14 to 20 fathoms. Its western end is about 7 miles from the shore on the meridian of Calais lighthouse ; from thence, it extends 7 miles eastward and then curves 9 miles in an E.N.E. direction to the position of the light-vessel, beyond which to the 10-fathoms line it extends $2\frac{1}{3}$ miles further, but with nothing less than 7 fathoms.

The bank rises almost perpendicularly from the bottom on its south-eastern side, but falls with a gentle slope north-westward. Those parts on which there are less than 5 fathoms form two flats, with a channel of from 5 to 9 fathoms and 2 miles wide between them ; from the centre of this channel, Gravelines lighthouse bears S.S.E., and Calais lighthouse S.W. $\frac{1}{4}$ S. ; vessels bound to or from either of these ports may pass over the shoal between these flats at any time of tide.

The western flat of the Outer Ruytingen, within a depth of 5 fathoms, is 7 cables wide, $3\frac{1}{3}$ miles long from West to East and has less than 3 fathoms for 2 miles of this extent ; from its shoalest spot

of only 10 feet, the church tower of St. Pierre les Calais is on with Fienne windmill S.S.W. $\frac{1}{2}$ W. ; Calais lighthouse S.W. by S. distant $8\frac{1}{2}$ miles.

The eastern flat within the 5-fathoms line is 9 miles long, and from 4 to 9 cables wide ; on its northern part are patches with only 15 feet ; on other parts, the depths vary from 18 to 26 feet.

The Outer Ruytingen occasions strong eddies and with a fresh breeze the sea breaks on the shoalest parts and is heavy on its edges. There are irregularities of bottom extending westward of this bank as far as Calais lighthouse bearing S. $\frac{1}{2}$ E., and those in small vessels should avoid crossing them in bad weather on account of the high sea they occasion.

LIGHT-VESSEL.—About one mile from the eastern end of the eastern flat of Outer Ruytingen, and in 10 fathoms, is moored a light-vessel exhibiting at 39 feet above the sea a *red flashing* light, *every twenty seconds*, preceded and followed by total eclipses, and is visible in clear weather from a distance of 11 miles.

The vessel, with mast and *red* ball, is painted *red* and *black* alternate streaks, with *Ruytingen* on sides, and lies with Dunkerque lighthouse bearing S. by E. $\frac{1}{4}$ E., distant $11\frac{3}{4}$ miles.

Fog signal.—A siren gives a group of *two blasts* of equal force, alternating about *every thirty seconds* with a *single blast*. In case of accident to the siren, a bell is sounded in similar order to that for the siren.

Buoys.—Three buoys mark the north-western side of the Outer Ruytingen great bank, viz. :—

North-east buoy, No. 3, *black* with staff and diamond, in 10 fathoms, nearly 2 miles W. $\frac{1}{2}$ S. from the Ruytingen light-vessel. Dunkerque lighthouse, bearing S.S.E., distant 12 miles.

Middle buoy, No. 5, *black* with a staff and cylinder, in 9 fathoms, with Dunkerque lighthouse bearing S.E. $\frac{1}{4}$ S., distant $12\frac{1}{2}$ miles, and 4 miles S.W. by W. $\frac{1}{4}$ W. from the North-east buoy.

South-west buoy, No. 7, *black* with staff and cone, point upwards, in 8 fathoms, near the western end of the eastern flat, W. by S. nearly 4 miles from the Middle buoy ; and Calais lighthouse bearing S.W. $\frac{1}{4}$ W., distant 11 miles.

Three buoys also mark the Outer Ruytingen little bank, viz. :—

North buoy, No. 2, *red* with staff and cone, point downwards, in $6\frac{1}{2}$ fathoms, 2 miles W. by N. $\frac{3}{4}$ N. from No. 7 buoy ; and Grave-lines lighthouse bearing S.S.E., distant $9\frac{1}{2}$ miles.

South buoy, No. 4, *red* with staff and two cones joined at their points, lies in 11 fathoms, $1\frac{1}{2}$ miles S.W. $\frac{3}{4}$ S. from No. 2 buoy; and, Calais lighthouse bearing S.W. $\frac{3}{4}$ S., distant $8\frac{1}{2}$ miles.

West buoy, No. 9, *chequered black and white* with staff and cone surmounted by a ball, in $6\frac{1}{2}$ fathoms, $2\frac{1}{2}$ miles W. $\frac{1}{4}$ N. from No. 4 buoy; and, Calais lighthouse bearing S. by W. $\frac{3}{4}$ W., distant $7\frac{1}{2}$ miles.

Inner Ruytingen.—The body of this bank lies $2\frac{1}{2}$ miles eastward of the northern part of Outer Ruytingen, and, including all shoal soundings of less than $8\frac{1}{2}$ fathoms, it is 8 miles long W.S.W. and E.N.E., and its greatest width is 3 miles. From its western extreme, Dunkerque lighthouse bears about S. by E. $\frac{3}{4}$ E. distant $9\frac{3}{4}$ miles; and, from its north-eastern extreme, S. by W. $\frac{1}{4}$ W. distant $12\frac{1}{4}$ miles.

Inner Ruytingen is of triangular form and its irregular depths cause an uneasy sea. The parts with less than 26 feet form two flats, separated by depths of from 5 to 6 fathoms. The western flat occupies the centre of the bank and is $2\frac{1}{2}$ miles long North and South and 2 miles wide, with as little as 9 feet in the centre, from which depth, Dunkerque lighthouse seen midway between Cassel and the spires at Bergues bears S. $\frac{2}{3}$ E.; and, Ruytingen light-vessel N.W. distant $2\frac{1}{2}$ miles nearly. The eastern flat is at the north-eastern part of the bank and is $1\frac{1}{2}$ miles long; its shoalest spot has 14 feet water.

The channel between Inner Ruytingen and Outer Ruytingen has depths of from 15 to 8 fathoms. Vessels may pass through it by keeping Gravelines lighthouse bearing S.W. by S. southerly.

Bergues bank.—This bank lies one mile northward of the north-eastern flat on Inner Ruytingen, and its least depth, 23 feet, lies with Dunkerque lighthouse bearing S. $\frac{1}{2}$ W., distant 13 miles. The eastern end of the bank is on the meridian of and 15 miles distant from Dunkerque, from thence it extends $3\frac{1}{2}$ miles W. by S. Some ridges with from 6 to 8 fathoms extend 4 miles eastward of the shoalest part of this bank, and, with a fresh breeze opposed to the tide, a heavy sea runs in the eddies on their edges, as well as on the edges of the Bergues.

Buoy.—A *black* buoy with staff and ball, No. 1, lies in 11 fathoms on the northern side of the shoal part of the Bergues; from it, Dunkerque lighthouse bears S. $\frac{1}{2}$ W. westerly, distant $13\frac{2}{3}$ miles.

DYCK BANKS form one continuous narrow shoal, on which the several banks are separated by depths of less than 6 fathoms. The south-western end of the shoal in 8 fathoms lies with Calais lighthouse bearing S.S.W. $\frac{3}{4}$ W., distant 6 miles; and then trends

eastward nearly parallel with the coast for 18 miles, almost to the meridian of Dunkerque, and then trends N.E. $\frac{3}{4}$ E. for $13\frac{1}{2}$ miles. The part between its western extreme and the meridian of Gravelines is West Dyck or Orteil; the central part, between Gravelines and Grande Synthe, Middle or The Dyck; and, the eastern part is East Dyck or Clif d'Islande.

West Dyck or Orteil is 9 miles in length, and its greatest breadth is about half a mile. From the least depth, 15 feet, Gravelines lighthouse bears South, distant $5\frac{1}{2}$ miles. For $2\frac{1}{2}$ miles both eastward and westward of this shoal part, the depths are from 19 to 25 feet, and, towards the western end, is a small patch with 27 feet. Those in small vessels should avoid passing near some patches of from 7 to 10 fathoms which lengthen out this bank westward almost to the meridian of Calais, as there is a confused sea on their edges with a fresh breeze opposed to the tide.

Middle Dyck or The Dyck is one continuous flat, $5\frac{1}{2}$ miles long E. by N. and W. by S., from 5 to 8 cables wide, and has from one to 5 fathoms, the shoalest spot being near the eastern end. The shoalest part of this flat is 4 miles long, on which the depths vary from 6 to 18 feet. From the centre to the eastern end it is extremely dangerous, being steep-to on all sides, but especially towards the North-west, where, at 2 cables distance, there are from 14 to 15 fathoms.

Gravelines lighthouse S.W. by S. in line with Dyck light-vessel, leads between West and Middle Dyck in about 19 feet.

East Dyck or Clif d'Islande is separated from Middle Dyck by a channel nearly 2 miles wide, in which the least depth is about 6 fathoms. The south-western end of this bank lies with Dunkerque lighthouse, bearing South, distant 7 miles, and, from thence trends N.E. $\frac{3}{4}$ E. about 14 miles. It is very dangerous throughout its whole extent, as it rises abruptly like a wall from soundings of from 11 to 17 fathoms. Its shoalest part, a flat 3 miles long, on the greater part of which there are only from 6 to 9 feet water, commences near the south-western end of the bank and extends north-eastward to the meridian of Dunkerque lighthouse. On the other flats of the bank the depths are irregular, varying from 10 to 17 feet.

The north-eastern end of East Dyck is a formidable danger; here the depths are only from 3 to 4 fathoms, and the sea is always disturbed around it, as it rises abruptly from depths of 15 and 17 fathoms and is therefore difficult to be avoided by the lead,

however quickly hove. From the shoal spot of three fathoms, West Hinder light-vessel bears N.W., distant $3\frac{1}{2}$ miles; Dunkerque light-house S.W. $\frac{3}{4}$ S., distant 19 miles; and, Ostende lighthouse S.E. $\frac{1}{2}$ E., distant $16\frac{3}{4}$ miles; but, this end of the bank being so far from the low land, the most remarkable objects can be recognised (even from the mast-head) only in very clear weather; at such times, Dunkerque light may be seen 5 or 6 miles further.

LIGHT - VESSEL.—Dyck light-vessel is moored in about 6 fathoms 3 miles in-shore of the shoalest part of West Dyck and with Gravelines pier-head lights bearing S.W. $\frac{1}{4}$ W., distant $2\frac{3}{4}$ miles, and shows at 39 feet above the sea, a *flashing white* light visible 11 miles. The *flashes* occur every *twenty seconds* and are preceded and followed by short eclipses. The vessel is painted with *red* and *black* bands, has the name *Dyck* on each side, and a *red* cage at the mast-head.

Fog signal.—A bell is sounded for *one minute* every *three minutes*, and *continuously* in reply to a passing vessel.

Inner Ratel.—This bank is, properly speaking, only a branch of Middle Dyck, being joined to its south-western end by a narrow 4-fathoms sandy ridge; it is high and steep-to on all sides, and, from its western end in 22 feet, $5\frac{1}{2}$ miles N. $\frac{1}{2}$ E. from Mardick church tower it trends E. $\frac{3}{4}$ N. for 7 miles, where, on and near its eastern end, shoal ground of from 15 to 25 feet rises suddenly from soundings of 7 or 8 fathoms. Its extreme breadth, about one mile, is near the middle of the bank, where there is a shoal flat 2 miles long with only from one to 9 feet, and with less than 6 feet for more than one mile of its extent. From this dangerous part, Dunkerque light-house bears S. by E. $\frac{1}{4}$ E., distant $5\frac{1}{2}$ miles.

The channel separating the Inner Ratel from the Breedt in-shore of it, is barred between the western flats of these banks by a heap of sand on which are about $3\frac{1}{4}$ fathoms. There are 8 and 12 fathoms in this channel at a short-distance eastward and westward of this bar.

Outer Ratel is an isolated bank, and within the 5-fathoms line is 9 miles long and about one mile wide; it lies south-eastward of and parallel with East Dyck, from which it is separated by a deep channel from 2 to $2\frac{1}{2}$ miles wide. Its name, meaning *rattle*, is perhaps derived from the noise caused by the heavy sea on it in bad weather. Near its south-western end, about one mile northward of the eastern end of the Breedt, is a dangerous flat with only 8 feet water. This shoal spot lies with Dunkerque lighthouse bearing

S.W. $\frac{1}{2}$ S., distant 10 miles, and then extends N.E. by E. easterly, $8\frac{1}{2}$ miles, including the shoal patches of $3\frac{1}{4}$ and 4 fathoms near its north-eastern extreme.

The Outer Ratel, having for $7\frac{1}{2}$ miles of its extent only from 9 to 15 feet, ought not to be crossed, even by small vessels, without great care. It is separated from East Dyck, as well as from the eastern end of Breedt, by soundings of from 7 to 12 fathoms. A bank, $1\frac{1}{4}$ miles long with only 25 feet, lies $1\frac{1}{2}$ miles N.N.W. $\frac{1}{4}$ W. from its north-eastern end, and is separated from it by soundings of from 10 to 13 fathoms.

Haut Fond de Gravelines, a small sandy flat $1\frac{1}{2}$ miles in extent on which the least water is 19 feet, lies $1\frac{1}{2}$ miles westward of the western end of Breedt bank; from the shoalest spot Gravelines lighthouse bears S. by W. $\frac{1}{4}$ W. distant $3\frac{3}{4}$ miles.

A *black* buoy with staff marks the southern extreme of the Haut fond de Gravelines.

Breedt bank is the largest of the Dunkerque banks, and joins the Inner Ratel by a bar of sand with $3\frac{1}{4}$ fathoms. Its western extreme in 5 fathoms lies $3\frac{1}{4}$ miles N. by W. from Gravelines point; from thence, it trends E. $\frac{3}{4}$ S. for $6\frac{1}{2}$ miles, and then $9\frac{3}{4}$ miles E. by N. $\frac{3}{4}$ N. to its eastern extreme in 5 fathoms, which lies with Dunkerque lighthouse bearing S.W. $\frac{1}{2}$ W., distant 10 miles.

There are three dangerous flats on the Breedt, with channels across the bank between them with not less than 15 feet. The western flat, with only 2 feet least water, is $2\frac{1}{2}$ miles long, lies 3 miles from the shore, is half a mile wide, and, from its centre, Mardick church tower bears South.

The middle flat, which is the largest, is 3 miles long by $1\frac{1}{2}$ miles wide; from its shoalest part, where, in 1879, $2\frac{1}{2}$ feet was the least depth found though formerly it used to uncover 5 feet, Dunkerque pier-heads bear South about 3 miles. The channel between this and the western flat has from 3 to $3\frac{1}{4}$ fathoms.

The eastern flat is 5 miles long N.E. by E. $\frac{1}{2}$ E. and S.W. by W. $\frac{1}{2}$ W., and 6 cables wide; it lies with Dunkerque lighthouse bearing S.S.W. $\frac{1}{4}$ W. distant 4 miles, and extends to within $1\frac{3}{4}$ miles of the eastern end of the bank; there are shoal patches of only 6 feet, and general depths of from 8 to 9 feet, on this flat; its western end is separated from the eastern end of the middle flat by an interval of one mile, with from 2 to $2\frac{3}{4}$ fathoms; but all these banks are very liable to temporary changes in form and depth.

East Breedt bank is a continuation north-eastward of Smal bank; within the 5-fathoms line, it is one mile wide and $5\frac{3}{4}$ miles long N.E. $\frac{3}{4}$ E. and S.W. $\frac{3}{4}$ W.; its shoalest part, commencing near the south-western end, is 3 miles long and half a mile wide, with from 13 to 18 feet. From the south-western end of this flat, Nieuport pier-heads bear S.S.E. $\frac{1}{4}$ E., distant $6\frac{3}{4}$ miles. The north-eastern extreme of the bank terminates in some shoal patches of 25 feet, of which the most eastern bears N. $\frac{1}{4}$ E. from Nieuport and is 9 miles distant from the pier-heads.

Smal bank.—The western end of this bank lies $2\frac{1}{4}$ miles from Dunkerque lighthouse, with the lighthouse and church tower in line; it is connected with the middle flat of Breedt bank by a bar with only 12 or 13 feet, and has as little as 2 feet within half a mile of this end. From its western end, it trends E. $\frac{1}{4}$ N. for 6 miles and then nearly 9 miles N.E. by E. $\frac{1}{4}$ E. to its north-eastern end, which bears N. by W. $\frac{1}{2}$ W. westerly, distant $5\frac{1}{2}$ miles from Nieuport pier-heads. The southern part of this bank, near its north-eastern end, joins Nieuport bank by a narrow bar with 18 feet water; here the towers at Furnes are on with the eastern part of a high sand-hill, named Broers Duin, bearing South. These banks bound Nieuport road on the North, and are extremely steep to near their point of junction.

Besides the small 2-feet flat at its western end, a dangerous flat about 8 miles long, with from one to 9 feet water, rises from Smal bank, commencing with Dunkerque lighthouse bearing S.W. $\frac{1}{4}$ S., distant 3 miles, and extends without interruption as far as N. by W. $\frac{1}{4}$ W. from Furnes. It is joined to the flat on Hils bank, in-shore of it, by a shoal bar of from 10 to 12 feet; from the centre of which bar, Dunkerque church tower is just open eastward of Leuquenaert tower. Between the eastern end of this flat and the north-eastern extreme of the bank, are several patches of from 9 to 16 feet.

BANK bounding DUNKERQUE ROAD.—The successive parts of this long bank are respectively named Snouw, Braeck, Hils, and Traepegeer. From the western end of the Snouw in 5 fathoms to the point of junction with the shore of the eastern part of the Traepegeer, the length of the united banks is not less than $16\frac{1}{2}$ miles; their width, from 3 cables to one mile. They give shelter to Dunkerque road, which is entered from the westward by West pass, and from the eastward by Zuydcoote pass, the whole of the southern side of the banks being well buoyed. See page .

Snouw bank, the western part of the long bank just described, is 4 miles in length E. $\frac{1}{2}$ S. and W. $\frac{1}{2}$ N. with less than 3 fathoms, and

its highest parts form a narrow flat $2\frac{1}{2}$ miles long with as little as 2 feet water at one part. The western end of Snouw is 2 miles N. by W. $\frac{1}{4}$ W. from Gravelines point.

A *black* buoy showing a *red* light is moored at the western end of Snouw bank.

LIGHT-VESSEL.—Snouw light-vessel, painted with *red* and *black* bands, has a cage at the mast-head and the name, *Snouw*, on sides; lies in about 11 fathoms in West pass, near the western end of the Snouw, and shows a *fixed red* light, visible in clear weather 8 miles. It is intended to withdraw this light-vessel.

Fog signal.—A bell is sounded for *one minute* every *three minutes*, and *continuously* in reply to passing vessels.

Braeck bank is only separated from the Snouw by a narrow 21-feet channel. It is about 5 miles long E. by S. and W. by N., beginning abreast of the centre of the Snouw, about $1\frac{1}{4}$ miles from the shore on the meridian of Mardick, and ending just eastward of the meridian of Dunkerque. On its highest parts, which form a flat, from one to 3 cables wide, are only from one to 2 feet, and some patches even dry at the lowest tides. The Braeck is steep-to, its sides rising from the bottom like a wall, and with northerly winds the sea breaks upon it with great fury. Its western end in $3\frac{1}{4}$ fathoms, and the shallow flats extending from the shore, are connected by a sandy shoal or bar in a W.S.W. direction across West pass. On this bar, there are 5 fathoms, deepening to 7 or 8 fathoms the moment it is passed in either direction.

Hils bank is a continuation of the Braeck, extending $3\frac{1}{2}$ miles further in an easterly direction and terminating suddenly in the Zuydcoote pass, the narrow 19-feet channel which separates it from Traepegeer bank. This end of Hils bank, at its south-eastern angle, is only $1\frac{1}{3}$ miles from the shore; and, N. $\frac{1}{4}$ W. from Zuydcoote tower, in ruins, and called also Sables or Sands tower. From this angle, the edge of the bank extends $1\frac{1}{4}$ miles N.E. $\frac{1}{2}$ N., forming the north-western side of Zuydcoote pass. The highest part of the bank forms a flat from 2 to 8 cables wide, on the southern part of which, large patches dry as much as 6 feet at low water, from which Dunkerque lighthouse bears S.W. by W.; and, on the remainder, are only from one to 6 feet. The southern side rises precipitously from depths of from $7\frac{1}{2}$ to 10 fathoms, rendering it exceedingly dangerous to vessels turning to windward in the eastern part of Dunkerque road, but for the buoys marking its edge. For buoys, *see* page 66.

Traepegeer bank bounds Dunkerque road eastward, and its western end forms the eastern side of East or Zuydcoote pass. The Traepegeer joins the shore in the neighbourhood of Broers Duin, the high sand-hill before mentioned, and from thence it joins Broers bank, which extends along the coast to the entrance of Nieuport. Its western extreme, on which there are from 7 to 13 feet, is only 2 cables from the south-eastern angle of Hils bank, and bears N. $\frac{1}{4}$ E. from Zuydcoote or Sables tower; the outer part of the bank extends from $2\frac{1}{3}$ to $1\frac{2}{3}$ miles from the shore, and the depths vary between 6 and 18 feet, though one part, near the centre and on the outer side, has only one foot water. For buoys, *see* page 66.

CAPE GRIS NEZ TO DUNKERQUE.

The **COAST** from cape Gris Nez trends E. by N. $\frac{1}{2}$ N. northerly 6 miles to cape Blanc Nez, the intermediate land is high, and may be seen in clear weather from a distance of from 15 to 20 miles; but beyond the latter cape the shore bends more eastward, the high land turns in a south-easterly direction towards the interior, and a level plain extends from its foot to the coast where it terminates in a low sandy shore bordered by ranges of sand-hills, the highest of which are visible only from 7 to 10 miles. Between the capes the shore forms a slight bay, at the head of which is Wissant village, inhabited by fishermen, 2 miles inland of which is mont Couple 514 feet high. From about one mile eastward of cape Gris Nez, where the cliffs of that cape terminate, to $1\frac{1}{2}$ miles north-eastward of Wissant, where the steep cliffs recommence, the coast is low and bordered by sand-hills.*

Cape Blanc Nez owes its name to the high chalk cliff in which it terminates. It forms no marked projection, but its position may be recognised from a considerable distance seaward by the guard-house on the summit of the steep mound which crowns it, and which is the northern extreme of a range of hills joining mont Couple. The last slopes of the high land forming the cape, as well as the steep coast in which they terminate, extends $1\frac{1}{2}$ miles eastward, nearly as far as Sangatte village, where the low sandy shore commences, which is the distinguishing feature of the remaining part of the French and of the Belgian coasts. The sand-hills are low to within $1\frac{1}{4}$ miles of Sangatte, but they gradually rise in height as they approach Calais, spreading into several parallel ranges which approach to within 2 or 3 cables of the shore.

* *See* Admiralty charts:—North Sea, No. 2,182a; Dungeness to the Thames, including Dover strait, No. 1,895; scale, $m=0\cdot68$ of an inch; Dover and Calais to Orfordness and Scheveningen, No. 1,406; scale, $m=0\cdot3$ of an inch; and Calais to river Schelde, No. 1,872; scale, $m=0\cdot7$ of an inch.

The principal objects on this part of the coast are the windmill of Coquelles, about 2 miles inland upon the last slopes of the range of hills extending eastward of cape Blanc Nez; the windmill at Nieulay, northward of this; the red buildings at Trouie or the Salines, situated about half way between Sangatte and Calais N.N.E. $\frac{1}{2}$ E. from Coquelles windmill, which are useful marks to the pilots who call them *les maisons rouges*; and the ramparts and citadel of Calais, which rise above the sand-hills, and may be seen from some distance at sea.

Telegraph cables.—The shore end of one of the submarine cables connecting England with the continent is landed in the bight just eastward of cape Gris Nez. Another from the South Foreland is landed at Sangatte.

CAPE GRIS NEZ LIGHT.—The lighthouse, a round tower, 79 feet high, is erected at a quarter of a mile southward of the cape, about 100 yards from the edge of the cliff, and exhibits, at an elevation of 226 feet above high water, *three white flashes* at intervals of about *three seconds*, followed by an interval of about *twelve seconds*, in the middle of which will appear a *red flash*. The light is electric, of the first order, and visible in clear weather 22 miles; the luminous glare of this light can be seen in ordinary weather, as much as 35 or 40 miles.

Fog signal.—A siren, worked by compressed air, established at cape Gris Nez lighthouse; will during thick or foggy weather, give *one blast* of *three seconds* duration, at intervals of about *one minute*.

Signal station.—There is a signal station close to cape Gris Nez lighthouse.

Tides.—It is high water full and change at cape Gris Nez at 11h. 27m.; springs rise $21\frac{1}{2}$ feet, neaps $16\frac{3}{4}$ feet.

Banc à la Ligne.—The great prominence of cape Gris Nez, and the sudden change there in the direction of the coast, occasions an extensive eddy north-eastward of it during the flood. This eddy has no doubt caused the formation of this bank of sand and broken shells, which extends 4 miles E.N.E. from the cape, and nearly 2 miles from the shore abreast. Wissant. Its shoalest part uncovers from 4 to 6 feet at low water springs, and towards its north-east extreme several heaps of sand, named la Barrière, have been formed, upon the highest of which there are only 3 feet at low water; the sea runs high upon them when a fresh breeze opposes the tide.

The south-western end of la Ligne bank has gradually joined itself to the land just eastward of cape Gris Nez, and there is now no channel at low water between the bank and the land; a new passage, named the North-west channel is formed near the middle of the bank.

A *red* buoy with a triangular top marks the north-east extreme of la Barrière sand. From the buoy Wissant church bears S. $\frac{1}{4}$ W., and cape Gris Nez lighthouse S.W. by W. It lies one-third of a mile W.N.W. from the 3 feet patch.

Les Gardes rocks.—The shore between capes Gris Nez and Blanc Nez is bordered by a sandy strand, uncovering in some places 4 cables seaward at low water. In front of all the steep parts of the coast flat rocks rise above the sand, and amongst them and furthest from the shore are those named Les Gardes, which uncover 7 feet at the lowest tides; from their outer extreme Wissant church tower bears S.W. by S. distant 2 miles, and the guard-house on cape Blanc Nez E. by N. nearly $1\frac{1}{2}$ miles.

Les Quenocs and Le Rouge Riden.—A rocky bottom, joining the shore and partly covered with sand, extends from Les Gardes to Sangatte village, and 2 miles into the offing between the bearings N.N.W. and E.N.E. from cape Blanc Nez; its shoalest part forms two distinct dangerous flats of irregular rocks, named Quenocs and Rouge Riden.

Quenocs the western flat, about half a mile in diameter, has two shoal heads with only 9 feet at low water; from its centre, the guard-house on cape Blanc Nez bears S. by E. $\frac{3}{4}$ E. about $1\frac{1}{2}$ miles, and Sangatte church tower E. by S. $\frac{3}{4}$ S. distant $2\frac{1}{4}$ miles.

Le Rouge Riden is nearer the shore, and nearly a mile in extent W.S.W. and E.N.E.; from its shoalest head of 6 feet near the western end the guard-house on cape Blanc Nez bears S. $\frac{1}{2}$ E. one mile. A shoal head of 9 feet also lies on the eastern edge of this flat, with the guard-house bearing S.S.W. $\frac{1}{4}$ W. distant $1\frac{1}{2}$ miles, and Sangatte church tower E.S.E. distant $1\frac{1}{4}$ miles. The sea runs high on both flats when a strong wind opposes the tide. Sangatte church tower in line with the windmill at Coquelles, bearing S.E., leads half a mile northward of Le Rouge Riden.

A *red bell* buoy No. 4 with *reflector*, in 3 to 4 fathoms, marks the north-eastern side of Les Quenocs, from it Calais west pier head bears E. $\frac{1}{3}$ S. nearly 6 miles, and Barrière buoy S.W. by W. $\frac{1}{3}$ W. $2\frac{1}{4}$ miles.

RIDEN de CALAIS, is about 4 miles long E.N.E. and W.S.W. and commences $1\frac{1}{2}$ miles N.E. by N. from Sangatte, ending N. $\frac{3}{4}$ E. about $2\frac{1}{2}$ miles from the entrance to Calais. The general depth on this bank varies from 5 to 8 fathoms; but shoal patches of from 25 to 28 feet exist near the centre. From the south-western shoal head of 25 feet the entrance to Calais harbour bears S.E. by E. $\frac{1}{4}$ E. distant $2\frac{3}{4}$ miles. The bank is dangerous at low water for vessels of deep draught only, but it occasions strong eddies, and during fresh winds from the northward there is a heavy sea on it, and breakers in north-east gales.

Buoy.—At the north-eastern extreme of the Riden de Calais is a *red conical* buoy with staff and globe, in 10 fathoms; from it Calais pier head bears S. $\frac{1}{2}$ E., distant $2\frac{1}{2}$ miles; Walde lighthouse S.E. by E. $\frac{1}{4}$ E. nearly 4 miles, and Outer Ruytingen west buoy N.E. $\frac{3}{4}$ N., distant $5\frac{1}{2}$ miles.

RIDENS de la RADE, also named the Têtes, lie N.N.E. about one mile from Calais pier-heads, and extend in an E.S.E. and S.E. direction to the shore, they consist of several heaps of sand, upon the highest of which there are 4 feet at low water. This shoal spot bears N.E. by E. $\frac{3}{4}$ E. from the east pier head from which it is distant 9 cables. The western patch of 18 feet is also distant 9 cables N. by E. $\frac{1}{4}$ E. from the same pier head. There are other patches of from 6 to 9 feet between these two. These dangers have almost entirely grown up in the last 50 years and seem to be steadily increasing. A heavy sea runs on them with on-shore winds.

Buoy.—In the centre of the deep between the Quenocs and these Ridens is a *black* buoy with a staff and St. Andrews cross, W. by N. $\frac{1}{2}$ N. about 3 miles from Calais pier-heads, and E. by N. nearly 3 miles from Quenocs buoy.

RADE de CALAIS, comprised between the Riden de Calais and the shore, affords anchorage with off-shore winds to vessels arriving off the harbour a few hours before the tide permits them to enter. A convenient position, in about 9 fathoms water and one mile off shore, is with Sangatte church tower in line with the guard-house on cape Blanc Nez, W. by S. $\frac{3}{4}$ S., and Calais lighthouse S.E. At night keep cape Gris Nez light opening and shutting with the cliffs at cape Blanc Nez, and anchor when Calais light bears S.E.

The road has depths of from 10 to 14 fathoms towards the Riden de Calais, and 7 to 9 fathoms at half a mile from low water mark at the westward, to 3 cables northward of Ridens de la Rade, the bottom

being sand mixed with broken shells; but according to the pilots the anchors penetrate into a good holding ground beneath the sand, and ships of the line and frigates have ridden out north-westerly gales without driving, when anchored under the southern part of the Riden de Calais. The holding ground is not so good near the shore.

The anchorage is sheltered by the land from W.S.W., round south, to S.E., but is quite open in all other directions. The Riden can scarcely be considered as a shelter, although the waves break with great violence during a northerly gale on its whole extent; the sea, however, is much quieter here than in the offing, and a vessel with good ground gear might ride out a gale in the northern part of the road.

Signal station.—There is a signal station on the shore about 6 cables westward of Calais west pier.

CALAIS.—The town of Calais situated at the south-west angle of a considerable plain, named Wattringues, which plain, devoted to agriculture, has been formed by the alluvial deposit from the river Aa, owes its importance to its geographical position which makes it the most convenient port for passengers and mails to and from the United Kingdom when time is the most important object to be considered. The buildings formerly confined to a small fortified space have in latter years greatly extended in a southerly and easterly direction; and a large part of the old enceinte has been taken down and the space it occupied devoted to enlarging the harbour and dock accommodation. The harbour is connected by rail as well as by a series of canals with Gravelines and Dunkerque, and with all the industrial region of Belgium and the north of France; and also, with Paris.*

Calais has some foreign and a brisk coasting trade; the vessels belonging to the port are chiefly employed in the cod, herring, and mackerel fisheries. The population was about 60,000 in 1891. The number of vessels entering the port annually, is about 2,000, of an aggregate of 500,000 tons. The imports are coal, iron, wood, jute, woollens, cottons, &c.; those for the year 1889 were valued at £7,110,783; the exports, straw, eggs, silks, Parisian goods, &c. The Packet steam boats cross between Dover and Calais three times each way, daily, the distance being accomplished under ordinary circumstances in about $1\frac{1}{4}$ hours.

* See Admiralty plan of Calais No. 2,556, scale $m=5$ inches.

NORTH SEA PILOT, PART IV., FIFTH EDITION, 1892.

(Slip to face page 55).

Calais.—The harbour has of late years been much improved in accommodation, and deepened ; great efforts are made to maintain the depths in the entrance channel.

As further improvements are hoped to be made on the one hand, and a temporary shoaling may take place on the other, the depths given in the channel must not be regarded as permanent.

When the new east jetty is completed and the existing jetty removed, it is contemplated to deepen the channel another 3 feet if possible.

Harbour.—The port of Calais is entirely artificial, and consists of a tidal harbour with powerful scouring basins; the Eastern and Western wet docks, the Canal wet dock, and a large dry dock. The quays are all connected by rail with the central railway station, and thus with all parts of Europe. The docks have direct communication with the canal system of France. On the quays there are hydraulic cranes, and extensive sheds for storing goods; there are also spacious landing stages for embarking and disembarking passengers.

Depths on the bar and in the channel.—The channel into Calais runs in a S.S.E. direction about 4 cables to the Tidal harbour; between jetties which at the outer end consist of open pile work, to prevent the accumulation of sand. This arrangement allows the tidal streams to sweep across the channel but is a serious inconvenience to vessels entering when the channel stream is at its full strength. During heavy weather, the bar and entrance are subject to great change.

The west pier has a small opening about $1\frac{1}{4}$ cables from the end to enable boats to load with sand; at its inner end it terminates in the towing path which passes under the glacis of fort Risban. The depth on the bar and in the channel to the Eastern wet dock is 13 feet at low water springs, and 29 feet at high water neaps; the entrance between the piers now 328 feet wide is being increased to 430 feet.

Caution.—With westerly gales which render the navigation of the English channel so dangerous the tide rises a foot or two higher than usual. Seamen should remember that during westerly gales, when Boulogne is impracticable to a sailing ship, Calais can be entered; and on the contrary, during north-easterly gales when it is impossible to enter Calais, Boulogne can be entered.

The Tidal harbour consists of two parts; in the eastern part called the Outer port which is 558 feet in width, are the South quay, 820 feet in length, with a depth of $26\frac{1}{4}$ feet alongside at low water ordinary springs; and the North quay, 1,800 feet in length, with a depth of $13\frac{1}{4}$ feet at low water ordinary springs. The western part, called the Import dock, and Bassin du Petit Paradis adjoining it, dry at low water springs, but have a depth of 16 feet at high water neaps, and 20 feet at high water springs. The total area of the tidal harbour is $35\frac{1}{2}$ acres.

Wet docks.—Eastern dock (Bassin Carnot), completed in 1890, is entered from the eastern tidal basin by two locks; one 436 feet in length and 69 feet in width, the other 450 feet in length and 46 feet in width, each with a depth of $28\frac{3}{4}$ feet on the sill at high

water springs. The depth in Bassin Carnot is 30 feet with the water at the level of high water springs, and its area including the interior basin is 29 acres, with 5,900 feet quayage. For dimensions of other docks *see* Dock Book.

The hydraulic cranes on the various quays consist of one of 40 tons, used for shipping coal by the waggon load, two of 5 tons, and ten of $1\frac{1}{2}$ tons. The quays are lighted by the electric light.

Dry dock.—The dry dock, at the southern end of Bassin Carnot, is 508 feet in length over all, with $68\frac{3}{4}$ feet width of entrance, and $28\frac{3}{4}$ feet water on the sill at high water ordinary springs. This dock can take a vessel 498 feet in length.

There is also a gridiron and careening slip at Calais but no establishment for repairs of consequence to vessels or machinery.

Scouring basins.—The total area of the two scouring basins is 432 acres, these are filled each tide and discharged through the entrance channel at low water to prevent the formation of a bar, and maintain a deep waterway.

Caution.—A swell runs into the entrance channel, the Outer port and Import dock, from half flood to half ebb when it blows strong from the northward.

Pilots.—Calais pilots cruise in small schooners as far westward as Dungeness and as far northward as the Galloper light-vessel. When unable to proceed to sea they indicate to approaching vessels the course to be steered by inclining a mast working on a hinge at the East pier-head, the mast being inclined to that side towards which the vessel should steer.

Steam tugs.—Steam tugs are attached to the port, and are ready whenever required.

Lifeboats.—In case of shipwreck there is a life preserving mortar and apparatus at three distinct stations at Calais. Also two lifeboats, one on the east, the other on the west side of the harbour.

LIGHTS.—Calais lighthouse, octagonal and 167 feet high, stands at the north-eastern side of the town, and exhibits, at 190 feet above high water, an electric *group flashing white* light showing successive groups of *four white flashes*, with intervals between the groups three times as long as the interval between the flashes of each group. The light is visible in clear weather 24 miles.

West pier.—A *fixed red* light, elevated 23 feet above high water, and visible 4 miles, is exhibited from an iron support at the extremity of the West pier. This light is not shown in bad weather, access to the West pier-head being then impracticable.

East pier.—From a white turret at the end of East pier at an elevation of 27 feet above high water a *fixed and flashing* light of different colours is shown to indicate the height of the tide above low water (*see* Night tidal signals).

There is also a *fixed green* light at the western extreme of the north quay of the new Outer port.

Fog signal.—A bell is sounded continuously in foggy weather from the turret of the East jetty when the port is accessible.*

For the use of the packet boats during foggy weather a gun is fired from the East pier-head every 5 minutes when the steamer is expected.

TIDES.—It is high water, full and change, in Calais harbour at 11h. 49m., springs rise 21 feet, neaps $17\frac{1}{2}$ feet. The tides rise higher with strong winds from N.W. to W.S.W. than they do with those from East to S.S.E.

The slack at high-water springs lasts about 20 minutes, and large vessels can be moved in the harbour during a period of $1\frac{1}{2}$ hours. The slack at neaps often lasts for three-quarters of an hour.

The mean duration of the flood or east-going stream at springs off the entrance to the harbour is $5\frac{1}{2}$ hours, and of the ebb or west-going stream $7\frac{1}{4}$ hours. At half a mile outside the piers the east-going stream runs $2\frac{1}{2}$ or 3 hours after high water in the harbour, and with strong westerly winds, $4\frac{1}{2}$ or 5 hours; with easterly winds it continues only $1\frac{1}{2}$ or 2 hours. The rate of the east-going stream at extraordinary springs is $4\frac{1}{2}$ knots.

TIDAL SIGNALS.—By night, tidal lights are exhibited from the white turret at the end of the East pier, as previously mentioned, they are as follows :—

A *fixed red* light indicates less than $6\frac{1}{2}$ feet rise above low water but tide rising.

A *fixed green* light indicates less than $6\frac{1}{2}$ feet above low water but tide falling.

A *fixed white* light indicates depths of from $6\frac{1}{2}$ to $7\frac{1}{4}$ feet, above low water.

* As no one is specially appointed to sound this bell it cannot be entirely relied on.

A *fixed white* light varied by groups of *red* and *green flashes*, indicates depths of more than $7\frac{1}{2}$ feet rise.

The groups of coloured flashes are separated by intervals of *eighty seconds*, and the flashes in each group by intervals of *five seconds*; each *red* flash showing an additional rise of $3\frac{1}{4}$ feet, and each *green* flash an additional rise of 10 inches more above low water.

While the tide is rising the fixed light of either colour is eclipsed for a short interval every *eighty seconds*, and when the tide is falling the light is eclipsed *twice* in quick succession every *eighty seconds*; these eclipses occur nearly in the middle of the intervals separating *groups* of *flashes*. No eclipse will take place at or about high water.

By day the tidal signals are hoisted on a mast and yard, and are the same as those generally used on the French coast. See page 21.

DIRECTIONS.—From the Westward.—As a general rule, cape Blanc Nez should be sighted when bound either to Calais, Gravelines, or Dunkerque. The most favourable winds for entering Calais harbour are those from W.S.W., round North, to East. Moderate on-shore winds only cause a heavy swell on the beach, but when strong they send in a heavy sea, and it is then dangerous to enter. Under these circumstances, which are frequent in winter, vessels bound for the northern ports of France should immediately run for Boulogne, and it should be borne in mind that at this, and at all French ports of importance, a *red* flag is hoisted at the mast head of the tidal signal staff when the port is rendered inaccessible by weather.

When running for Calais from the South-west, when on the parallel of and about one mile from cape Gris Nez, steer about N.E. by E. $\frac{1}{4}$ E., taking care not to bring the extremity of the cape to the westward of S.W. $\frac{1}{2}$ W. in order to keep outside the Barrière and the Quenocs rocks. When Sangatte church tower is in line with Coquelles windmill, bearing S.E., steer about E. by S. $\frac{1}{2}$ S. towards Calais lighthouse, passing the *black bell* buoy on the port hand, and when abreast the buoy, or when Audinghen church tower is hidden behind the cliff at cape Blanc Nez, if there is water sufficient to enter the harbour a course should be shaped for the entrance; if not, an anchorage should be sought for in the southern part of Calais road.

Small vessels may pass at all times of tide between the Quenocs and the Barrière, by keeping Sangatte church tower on with either of the three towers of Calais; they may also pass between the Rouge Riden and the shore from half flood to half ebb.

At night cape Gris Nez light should not be brought to the westward of S.W. $\frac{1}{2}$ W. to avoid the Barrière and the Quenocs, and when Calais light bears E.S.E., steer about E. by S.; then, if the ebb or western stream is running, anchor as soon as cape Gris Nez light is about to be hidden behind the cliff at cape Blanc Nez; but if the flood is making and there is sufficient water at the entrance, steer for the *red* light on the West pier-head, which must be rounded close to.

From the Northward.—Between one-third flood and two-thirds ebb in Calais harbour, either by day or night, vessels from the northward with a fresh fair wind may run directly for the entrance over the Riden de Calais, where there is then sufficient water. If late on the ebb, run on the meridian of cape Blanc Nez until Sangatte church tower is in line with Coquelles windmill, S.E., then steer, if the weather is favourable, for the anchorage in the southern part of Calais road.

At night steer for Calais light on an E.S.E. bearing, until cape Gris Nez light bears W.S.W., then, attending to the lead, steer E. $\frac{1}{2}$ S. until the light on cape Gris Nez is just masked behind cape Blanc Nez, when anchor, if the ebb is running, or if the flood, steer for the harbour.

Entering the harbour.—The most favourable time for entering Calais harbour, with an on-shore wind is at the moment of high water; but with the wind abeam or ahead, at half or three-quarters of an hour before that period, so as to have time to be tracked up to the quays, or into the wet dock. It should, however, be borne in mind that during calm weather, at half a mile outside the entrance, the flood or east-going stream continues to be felt $2\frac{1}{2}$ or 3 hours, and with strong westerly winds $4\frac{1}{2}$ to 5 hours after high water in the harbour, and it is at its greatest strength at the time of high water there. For this reason, whatever the direction of the wind, the West pier-head should be steered for, to avoid being set to the eastward of the entrance, and this precaution is particularly necessary when standing for the harbour on the starboard tack; the bower anchors and a stern anchor should then be ready for letting go, and hawsers ready to run out in the event of being drifted on the East pier. All sail should be carried, especially with the wind right aft, to stem the flood and to pass quickly through the swell at the entrance. Should a vessel with a strong westerly wind and without a pilot miss the entrance, anchor immediately, as near as possible to the East pier-head, and take in a pilot, whose assistance will then be indispensable.

Vessels may get out of the harbour and gain an offing on a weather tide against a head wind, by making sail from the end of the West pier.

Coal.—There is always a moderate stock of coal at reasonable prices, and every facility for coaling either in the harbour or docks.

The COAST.—The sand-hills forming the coast between Calais and Gravelines may be seen in clear weather from a distance of 8 or 9 miles, but some parts are so low that embankments are thrown up as a protection against the sea. The only objects that can be recognised on the level land adjoining the shore are, the two windmills at Walde, Oye church spire, the two windmills standing near Oye village, and the telegraph cable beacons at the Huttes d'Oye.

At low water, the sandy strand extends one mile from the shore between Calais and the meridian of Walde windmills, as well as off the entrance to Gravelines; but, along the intermediate coast, its breadth varies from a half to three-quarters of a mile. Depths of less than 4 fathoms adjoining the beach, extend nearly 2 miles from the shore N.N.E. of Calais church and abreast of Gravelines, and about one mile from the shore between Walde and Oye windmills; between the outer edge of these soundings and high-water mark, the slope of the bottom is steep and somewhat irregular, which tends to cause a heavy sea with on-shore winds.

WALDE LIGHT.—Near the outer edge of the sandy strand which dries at low water, springs, 8 cables from the shore at Walde point, and 3 miles E. by N. $\frac{3}{4}$ N. northerly from Calais lighthouse, is an iron beacon 59 feet high, from which, at 36 feet above high water, is exhibited a light showing *white* and *red* alternately during *twenty seconds*, the *red flash* lasting *four seconds*, the *white flash* *sixteen seconds*, with no eclipse between; the light is visible in clear weather 11 miles.

Telegraph cable.—The telegraph cable between France and Denmark (from Calais to Fano island), leaves the shore near the Huttes d'Oye, in longitude $2^{\circ} 2\frac{1}{2}'$ E., and lies in a N. $\frac{1}{2}$ E. direction for $7\frac{1}{2}$ miles to latitude $51^{\circ} 7' 10''$ N., and longitude $1^{\circ} 59' 39''$ E., at which point it takes the direction of N.E. $\frac{2}{3}$ N., passing close westward of No. 7 Outer Ruytingen buoy. The first of these directions is indicated by two beacons on the shore, each surmounted by a hexagonal prism, partly *white* and partly *red*. Vessels should not be anchored in the direction indicated by these beacons.

Caution.—Shipwrecks are frequent between Calais and Gravelines; they are in great measure attributable to neglect of the lead,

and to inattention or want of knowledge as to the times of change of the tidal streams, which are *much later* at the Galloper light-vessel (from whence vessels from the North sea usually take their departure) than on the French coast.

GRAVELINES.—The entrance to this small tidal harbour lies 10 miles eastward of Calais, and its position may be easily recognised by the houses of Fort Philippe village built close to the sea on each side of the entrance channel, by a windmill about a quarter of a mile eastward of the village, and by the fine tower of the lighthouse. The port itself is situated under the ramparts of the north-western part of the town of Gravelines, at the mouth of the river Aa, but about one mile within the coast-line; from the offing, however, the town, except the towers of the cathedral, is hidden from view by trees.

About 200 vessels, of which a fair proportion are steamers, enter the port annually bringing about 25,000 tons of merchandise; the principal imports being wood, coal, woollen goods, bricks, and cement; the exports, eggs, fruit, vegetables, &c. Vessels are also fitted out for the herring, cod, and mackerel fisheries. The population of the port is about 8,500.

Depth on the bar.—The entrance to the channel leading into Gravelines harbour is frequently obstructed by a bar formed of the sand driven in by westerly winds and sea. The height and extent of this bar depend both on the duration of these winds and on the body of fresh water running out of the harbour. At its medium state, it is from 2 to 3 feet above the level of the fresh water running through the channel when the tide is out, or 5 or 6 feet above the level of the lowest tides. When the great freshets of the river Aa are accompanied by north-easterly winds, it sometimes disappears altogether for several days.

The harbour is accessible to vessels of 15 feet draught at high water springs. At weak springs, those of $11\frac{1}{2}$ or 12 feet can enter it during 5 or 6 days, that is to say, for 2 or 3 days before full and change, and 3 days after. It affords good shelter, at springs, to vessels of about 12 feet draught during westerly gales, especially those between W.S.W. and W.N.W., when the sea is not heavy at the entrance; but, the bar should be crossed at about high water. In a gale from E.N.E. or East, vessels should run in with the flood, for, after high water, there is some difficulty in stemming the ebb. The tide rises much higher with strong northerly winds, but, as the sea is then very high at the entrance, no vessel drawing more than 12 feet should attempt to enter, unless embayed and with no

possibility of reaching Dunkerque road, which is the only place on this coast where, with strong northerly winds, a vessel may find a partially sheltered anchorage.

The Entrance channel trends S. by E. $\frac{1}{4}$ E. for 2 miles in a direct line from the pier-heads and consists of two distinct parts, one bounded by the piers, the other, by the land from Fort Philippe village to Gravelines.

The outer part of the channel, 8 cables long and 305 feet wide at the entrance, is enclosed between two low stone piers, of which, that on the eastern side does not cover at high water for the greater part of its length from the shore, and is terminated by 330 yards of wooden jetty. The western pier has recently been raised similarly to the eastern one. Abreast of the pier-heads, the level of the fresh water of the river when the tide is out, is 3 feet above the level of low water, extraordinary springs.

The inner part of the channel, between Fort Philippe village and the harbour, is rather more than one mile long and half a cable wide, and is enclosed between embankments which serve for towing paths. The deposit in the channel forms a steep slope on either side, which, in the summer, is partially cleared away by scouring waters released by sluices from the fosses of the fortifications; but, at other seasons, the abundant freshets of the river Aa caused by rain and by the melting of the snow, clear both harbour and entrance channel of the mud and sand which accumulate in dry weather.

The Tidal harbour is on the north-western side of the town, and is only about $1\frac{1}{2}$ cables long, occupying half the breadth of the channel by which the course of the Aa has been straightened between the ditches of the western part of the fortifications and the entrance channel. There is a small gridiron and careening place in this harbour where vessels of 150 or 200 tons can be received. The berths of muddy sand, alongside the stone or wooden quays bordering the whole length of the harbour on the town side, are $4\frac{1}{4}$ feet above the level of low water, springs. The swell from outside never reaches the tidal harbour.

The Wet dock, or Bassin Vauban, is 1,083 feet long by 147 feet wide; it is entered from the tidal harbour by dock gates 33 feet wide, and it again communicates with the river Aa, and hence with the in-land navigation by other gates. It is also in communication with the railway by means of a siding. The sill at the entrance is on the level of low water, springs; at high water, springs, there are 18 feet water, and at ordinary neaps, 15 feet over it.

There is a gridiron 121 feet long.

Signal station.—There is a signal station close to the lighthouse.

LIGHTS.—Gravelines lighthouse, a white circular tower resembling a Doric column, stands on the shore at the eastern side of the channel. It exhibits, at 95 feet above high water, a *fixed white* light, visible 15 miles.

West pier.—A *fixed green* tidal light, visible 4 miles, is exhibited from iron supports above a shed on the new West jetty-head ; this light is 25 feet above high water and is shown from *two hours* before to *two hours* after high water.

East pier.—A *fixed red* light, visible 4 miles, is shown from a similar structure on the East pier-head ; this light is exhibited all night, and is also 25 feet above high water.

Tidal signals.—The usual day tidal signals, *see* page 21, are in use at this port.

Tides.—The streams do not turn with high and low water ; at the highest tide the east-going stream is at its greatest strength or about 3 knots.

It is high water, full and change, in Gravelines harbour at noon, springs rise 19 feet, neaps $15\frac{1}{2}$ feet. And, above the level of the fresh water stream at the harbour entrance when the tide is out, which is about 3 feet above the level of the lowest tides, equinoctial springs rise 20 feet ; ordinary springs, 18 feet ; ordinary neaps, 12 to 15 feet. A deduction of 2 feet from these heights gives the rise on the bar when in its medium state. Strong winds from N.W. to N.N.W. cause the tide to rise higher, and those from S.E. have a contrary effect.

The tide rises slowly for the first three hours, but its rise is rapid from the third to the fourth hour ; it then rises gradually until high water. At springs, the high water slack in the harbour continues about 15 minutes in calm weather, from 20 to 30 minutes with westerly winds, and 10 minutes at the utmost with off-shore winds ; but, as there is little rise for the last half hour's flood and fall in the first half hour's ebb, there is practically a period of $1\frac{1}{2}$ hours for moving vessels in and out without danger of grounding.

Pilots are stationed at Gravelines ; they cannot get out to vessels when the sea is high on the bar, in which case they go as far as they can and wave a flag to indicate the direction in which vessels should steer.

A lifeboat is stationed at Gravelines.

A steam-tug is stationed at the port and is available when required.

Directions.—Those arriving off Gravelines harbour some time before the tide serves, may anchor northward of Oye church spire, at $1\frac{1}{2}$ or 2 miles from the shore (being careful to avoid the telegraph cable mentioned on page 60), in, from 5 to 8 fathoms, excellent holding ground; this anchorage, however, is only safe during fine weather, for the sea is heavy with on-shore winds.

The most favourable winds for entering the harbour are those from N.N.W. to N.E., but, if fresh, they cause a high sea at the entrance, and it is then necessary to be quite certain there is sufficient water over the bar to avoid striking. With fresh winds from W.S.W. to W.N.W., the sea is smooth on the bar, but there is some difficulty in getting through the entrance channel when the east-going stream and sea crossing it may drift a vessel on the East pier. The entrance is easy with north-easterly winds when they are sufficiently strong for a vessel to stem the east-going stream, which is at its greatest strength at the time of high water in the harbour. With a head wind, a sailing-vessel is either tracked or towed in.

The best time for entering the harbour is about an hour before high water, although the stream at that time runs strongly across the entrance and there is some difficulty in keeping in the deepest parts of the channel; but, if the vessel takes the ground off Fort Philippe, with a rising tide, she will float again before high water and get up to the harbour. Bower and stern anchors must be ready to let go, and hawsers to run out, should the vessel be drifted on the East pier.

Sufficient sail should always be carried to ensure good steerage, especially during the autumn and winter months when it often blows fresh in the offing whilst the breeze is light near the shore; those, therefore, under suitable sail in the offing, must be prepared to make more sail as they approach the harbour or they may be in considerable danger in the heavy swell on the bar. When entering the channel with westerly winds, whatever their strength, or with light easterly winds, keep close past the West pier-head. With fresh easterly winds, run directly for the middle of the entrance.

The **COAST**, from the entrance to Gravelines to that of Dunkerque trends E. $\frac{1}{4}$ S. southerly, for $10\frac{1}{2}$ miles; the low plain behind the shore between the two places presents no remarkable objects

visible from any considerable distance at sea. The only high lands visible in clear weather are, the Great and Little Cassel, two isolated hills S. $\frac{1}{2}$ W. from Dunkerque. The town of Cassel stands on the summit of the Great Cassel; the other hill is of a conical form. The buildings recognisable near the coast are, the tower and lighthouse at Dunkerque, and the church towers of Grande and Petite Synthe and of Mardick.

Gravelines point, situated 4 miles E. $\frac{1}{4}$ S. southerly, from Gravelines pier-heads, is of a rounded form, and the sand-hills composing it lie in several parallel ridges and are visible in clear weather 9 or 10 miles; at its outer extreme is a large wooden beacon.

A chain of sand-hills covered with verdure extends 2 miles in a W.S.W. direction from the point, and those bordering the shore for about 2 miles eastward are about the same height as those at the point, but, beyond this, and to within a short distance of Dunkerque, they are covered with coarse grass and lie in parallel ridges half a mile in the rear of an embankment fronted by low land which covers at high water, springs.

Between the entrance of Gravelines and Gravelines point, the sands dry more than half a mile out from the beach, at springs; abreast of the point, they dry 3 cables; and, between the point and Dunkerque, 6 or 8 cables. The sand carried eastward by strong westerly winds, is arrested by the jetties at Dunkerque and accumulates between Mardick and Dunkerque, where it forms an immense heap of which the highest parts barely cover at springs. Of all the obstacles to the improvement of Dunkerque, this high bank of drift sand is the most difficult to combat; for, drifting over the West jetty, it formerly caused a bank several feet high to form at the jetty-head and across the entrance.

Mardick bank, Fosse de Mardick, &c.—The soundings off this part of the coast, within a depth of 5 fathoms, are very irregular and the sea heavy with on-shore winds. Between the entrance to Gravelines and Gravelines point, these soundings extend in places 2 miles and upwards from the shore; and, on these shallows, the Mardick bank, with a general width of 5 or 6 cables and depths of from 7 to 18 feet, extends $3\frac{3}{4}$ miles parallel with the shore, its western end joining the shore sands about one mile eastward of Gravelines piers. Another shoal, of which the outer edge is steep-to, joins the strand between Mardick and Dunkerque, and, extending $1\frac{1}{2}$ miles from the shore, forms, with the Mardick bank, the southern

side of West pass; its western end in 3 fathoms is 6 cables eastward of the eastern end of the Mardick bank, and bears N. by W. $\frac{1}{2}$ W. from Mardick church tower. In-shore of this and of the Mardick bank, is the Fosse de Mardick, which has from 19 to 33 feet water, but should always be avoided as each end terminates in a blind channel.

WEST PASS into DUNKERQUE ROAD.—From the *black* buoy showing a *fixed red* light, marking the western extreme of Snouw bank, to abreast of Dunkerque, this pass is 7 miles long, and it lies between the shoal flats joining the shore and the Snouw and Braeck banks. The entrance to it, as well as the direction it follows, is marked by buoys. *Black* on the northern side, three of which have *red fixed* lights; and *red* on the southern side, two of which have *white* lights; the western of these two is *flashing*, the other is *fixed*.

ZUYDCOOTE or EAST PASS into DUNKERQUE ROAD.—This pass is very narrow; it lies between Hils and Traepegeer banks and has from 19 to 22 feet water, *see also* page 50; its limits are defined by two *black* and two *red* buoys, the southern edge of its bank is marked by *red* buoys.

The *black* buoy No. 1 moored at the north-west part of Traepegeer bank is not surmounted by a ball; the *black* buoy moored at the north-east part of the bank is surmounted by a ball.

Caution.—The *red* buoys on the eastern slope of Hils bank, which is very steep, have sometimes drifted across Zuydcoote pass to the western slope of the Traepegeer; this has frequently happened to No. 4 *red* buoy. Mariners should, therefore, be on their guard, though the greatest care is taken to keep the buoyage of both passes in proper condition, a Government steamer being specially assigned for that duty.

Directions.—The general direction through the Zuydcoote pass from the eastward is about S.W. $\frac{1}{2}$ W., with No. 4 *red* buoy on the port bow until past No. 2 *red* buoy, when No. 4 should be brought gradually on the starboard bow; this leads through in the deepest water. When the east going stream begins to be felt in Dunkerque road, which is about the time of half flood in the harbour, the tide has risen 9 feet in Zuydcoote pass. and the largest vessels that can enter Dunkerque may at that time pass over the south-western end of the Traepegeer by keeping the spires of Bergues church open about one degree westward of Leffrinckoucke church tower bearing about S.S.W. $\frac{1}{2}$ W.

If a vessel's draught permits turning through the Zuydcoote pass between half flood and half ebb, the lead must be hove quickly to avoid coming suddenly upon Hils bank; and, when standing eastward, do not open the spires of Bergues more than two degrees eastward of Leffrinckoucke church tower.

At night, those in small vessels entering by this pass, and unable to distinguish the colour of the first buoy they see, cannot do wrong in passing close eastward of it; for, if it should be No. 1 *black* buoy of the Traepegeer, there is enough water for them for 4 cables eastward of it, and if it should be No. 2 *red* buoy of Hils bank, by keeping eastward of it they will be in the middle of the pass.

DUNKERQUE ROAD being narrow, and only sheltered by banks of which the greater part are always covered, can only be considered as a temporary anchorage for merchant vessels whose draught permits them to enter the harbour. In heavy weather, sharp vessels deeply laden might be in some danger from the sea, but, with this exception, the pilots consider that a vessel with good ground tackle may ride out a gale from the offing; and, in the winter of 1870-71, a French squadron remained for many months in the road and reported favourably of it; the banks, even at high water, affording sufficient shelter to large ships.*

The road is comprised between the 5-fathoms line in-shore, and the Braeck, Hils, and Traepegeer banks, on the off-shore side. It extends from the western end of the shallow flat of the Braeck, north-eastward of Mardick tower, to the entrance of Zuydcoote pass.

The Great road or western deep, with from 8 to 9 fathoms, good holding ground, commences north-east of Mardick tower, extends to the line of bearing, Dunkerque lighthouse S.E. by S., and is in some degree sheltered from the sea during northerly gales by the high flat on the Braeck bank. It is in this part of the road that vessels of deep draught anchor, with westerly winds and a heavy sea, when they have to wait for high water to enter Dunkerque. Small vessels under similar circumstances may anchor about one mile N.W. from the harbour entrance, the holding ground there being good; this is also a good position for all vessels with off-shore winds.

The Little road or eastern deep commences with Leuquenaert tower on with Dunkerque lighthouse, and extends to Zuydcoote pass in from 8 to 9 fathoms, and the holding ground is good,

* See Admiralty plan :—Dunkerque road, No. 1,352; scale, $m = 4.2$ inches.

especially N.N.E. of Dunkerque. Large vessels remaining some time in Dunkerque road should anchor in this deep between the lines of Leuquenaert tower touching the eastern side of the light-house, and the same tower on with Dunkerque tower; here they are better sheltered than in the western deep during gales from N.N.W. to E.N.E. by the high flats on Braeck and Hils bank; and, in the event of parting, it is much less dangerous to run ashore eastward than westward of Dunkerque. In any part of the road, vessels should have a spare anchor ready if the wind veers and threatens to blow hard from the northward.

The Tidal streams do not turn at high and low water but at about half tide. The first of the flood or east going stream in Dunkerque road comes from N.N.W.; as it gains strength it turns more eastward, and, at its greatest speed ($3\frac{1}{2}$ knots), which lasts about two hours, it runs straight through the road. It then decreases rapidly, and, after a few minutes slack water, the ebb or west going stream commences, running N.N.W. at first, and, as its rate increases, turning westward, and running parallel with the coast when at its greatest strength; towards the end of the tide, its direction is W.S.W. and S.S.W. The flood or eastern stream runs for $2\frac{3}{4}$ or 3 hours after high water in the harbour; *see* tides, page 71.

DUNKERQUE, 10 miles eastward of Gravelines, formerly an arsenal and naval port, is now the principal French commercial port in the North sea. The town stands at the junction of Bergues, Bourbourg, and Furnes canals, and the public buildings are spacious, handsome, and regular. As this port is one principal outlet for the great manufacturing Department du Nord, the trade by sea is very large. The cod and herring fisheries are also carried on with great activity. The trade of the port was represented by 1,840 vessels entering in 1890, their aggregate tonnage being 1,362,596 tons. The population in 1891 numbered 40,513.*

There is a town hospital at which foreign sailors are received at two francs per diem; cases of small-pox or typhoid are sent to the Lazaret, where the charges are much higher. There is also a Sailor's Home and British Seamen's Institute.

The principal imports are ores, coal, cereals, seeds, molasses, nitrate of soda, wood, wool, flax, petroleum, jute, and pig iron. The exports are principally coal, forage, potash, rails, and casks. In 1890 the total value of these were £2,447,119.

* *See* Admiralty plan :—Dunkerque road, No. 1.352; scale, $m = 4.3$ inches.

Dunkerque is in railway communication with all parts of France and the Continent, and through Furnes, with Belgium. The telegraph service is also very good. By sea, there is regular steam service to London, Hull, Goole, Leith, Rotterdam, St. Petersburg, Havre, Bordeaux, and Marseilles.

The port consists of an entrance channel leading to an outer tidal harbour, at the end of which is an inner tidal harbour and four wet docks or basins. Great improvements have been effected in the entrance and tidal harbours of late years by dredging and otherwise, and extensive harbour works are still (1891) in progress.

Depths at entrance.—The depths at the entrance and in the channel is 26 feet at high water ordinary springs, and 20 feet at neaps.

The heaviest draught vessel that has visited Dunkerque was of $23\frac{1}{2}$ feet draught (1890).

Northerly gales cause such a high sea outside the jetties that vessels above 16 feet draught should not attempt to run in at such times unless the pilots judge the entrance practicable; small vessels may enter at the top of high water by carrying all possible sail to get through the heavy sea, but, at neaps, the entrance is inaccessible during these gales to all except coasters.

The Entrance channel is about one mile long N.N.W. and S.S.E., and 230 feet wide (but is in process of widening to 420 feet); it is enclosed partly by the citadel quay and the extension of the town quay as far as the Cunette sluice, and partly between wooden jetties extending across the sands which uncover at low water. The sand forces itself into the channel through the openings in the pilework and through the entrance, especially during dry weather and at neaps. Water from the canals of the interior and from the ditches of the town, is used to scour the harbour and entrance channel, but, although the stream is rapid, it has so far to run that its effect does not extend much beyond the jetty-heads, and does not suffice to keep the entrance clear. Constant dredging by steam dredges of peculiar construction, however, in conjunction with flushing, enables the harbour authorities to maintain a depth both within and outside the jetties of 9 feet water at the lowest tides.

During rainy weather, and at the melting of the snow, when the water in the interior is abundant, the stream runs strongly out of the channel all the time the flood is weak and is checked only when the tide rises rapidly; it recovers its course as soon as the tide slacks, about half an hour before high water, and as soon as the ebb makes

it acquires great strength. This stream causes very little inconvenience to vessels of deep draught entering before high water, but, as soon as the tide begins to fall, they must have a strong fair wind to get through against it. Vessels lying anywhere in the inner parts of the channel, require to be well secured in strong northerly winds, when the swell makes itself felt both in the entrance channel and tidal harbour.

The Tidal harbour is about 3 cables long, from 400 to 500 feet wide, and surrounded by quays where several lines of steamers have their regular berths. It is available for vessels of $8\frac{1}{2}$ feet draught at low water springs, and the bottom is a mixture of sand, shingle, and mud, vessels lying alongside the quays on a much thicker bottom of mud than in the inner tidal harbour. Strong northerly winds cause the swell to enter this harbour for about 2 or 3 hours each high tide, but it does not inconvenience a vessel well secured.

Wet docks.—The four wet docks, or bassins-a-flot, are named respectively, the Bassin Freycinet, du Commerce, de la Marine, and de l'Arrière port.

The Bassin Freycinet, or de l'Ouest, has an area of 20 acres, and an entrance lock 394 feet long and 66 feet broad, with a depth over the sill at high water, springs, of 24 feet 5 inches. This basin has quays only on the side near the town, the other side being merely embankments through which will be the openings to the large basins under construction.

The largest vessels yet admitted to any of the docks was a steamer of 2,550 tons, and 23 feet 3 inches draught of water.

For dimensions of smaller docks, *see* Dock book.

Dry docks.—There are two dry docks that are 328 feet on the blocks, 46 feet wide at the entrance and from 20 to $24\frac{1}{2}$ feet over the sill. Larger docks are under construction. *See* Dock book.

Repairs to a moderate extent both to hull and machinery can be effected, vessels of 800 tons can be built, and those of 1,000 tons repaired on the patent slip.

LIGHTS.—**Dunkerque lighthouse**, a yellow brick circular tower 187 feet high, stands between the inner end of the West jetty and the ruins of fort Risban. It is 875 yards S. by E. $\frac{1}{2}$ E. from the West jetty-head, and exhibits, at 193 feet above high water, a *group flashing electric* light of the first order showing successive groups of *two white flashes* each, the interval between two consecutive groups being three times as long as the interval between the two flashes of a group. The light is visible in clear weather 20 miles.

Leuquenaert.—A *fixed white* light at 85 feet above high water is exhibited from the Leuquenaert (l'Heugena) tower 2,406 yards S.S.E. from the entrance. This light, specially intended to indicate the direction of the entrance channel, shows its brightest light when bearing S.S.E., and on that bearing is visible 15 miles. Right or left of this direction, the light is visible only within an angular space of 10° or 12° , and from a distance of 5 or 6 miles.

East jetty-head.—A *fixed red* light is shown from the extreme of the East jetty at 26 feet above high water, and is visible 4 miles.

Tidal light.—West jetty.—From a white turret 49 feet within the West jetty-head, at 33 feet above the sea, is exhibited a *tidal* light, visible 9 miles, varying in colour, and indicating by *colour* and *flashes* the state of the tide, every 10 inches of rise above a depth of $6\frac{1}{2}$ feet being shown, thus :—

When the tide is less than $6\frac{1}{2}$ feet above low water, springs, and rising, the light shows *red*; when less than $6\frac{1}{2}$ feet and falling, the light shows *green*; when between $6\frac{1}{2}$ and $7\frac{1}{4}$ feet the light shows *white*.

With $7\frac{1}{4}$ feet and upwards, the light shows *white* with groups of *coloured* flashes at intervals of *eighty seconds*. The *flashes* in each group are shown at intervals of *five seconds*, each *red* flash adding 3 feet 4 inches to the initial height of $6\frac{1}{2}$ feet, and each *green* flash 10 inches more.

With a rising tide, the *fixed* light, whether *red* or *white*, is eclipsed for a short period *every eighty seconds*; and, with a falling tide, the *fixed* light, *white* or *green*, is eclipsed *twice* in quick succession during the same period.

At or near high water, the light is not eclipsed. When the *fixed white* light is varied by groups of *coloured flashes*, the eclipses take place about the middle of the interval separating the groups.

Fog signal.—A large bell on the head of the west jetty is rung for *one minute* at intervals of *one minute*, and continuously in answer to fog signals from an approaching vessel.

Day tidal signals.—The day tide signals are those in use at all the French ports, *see* page 21. They are made from a flagstaff on the terrace of a little building 109 yards S.S.E. from Dunkerque lighthouse.

Tides.—It is high water, full and change, at Dunkerque, at 0h. 8m.; springs rise $16\frac{3}{4}$ feet, neaps $13\frac{1}{2}$ feet; and, 9 feet added

to the rise gives about the average depth at high water throughout the entrance channel. Strong northerly winds raise the tide 2 or 3 feet higher, but the sea is then heavy at the entrance. When easterly winds prevail, springs do not rise much higher than neaps with fresh westerly winds. In the harbour, in calm weather, high water slack lasts about 15 minutes; with westerly winds, 20 or 25 minutes; and, with off-shore winds, 10 minutes.

A short distance outside the jetties, the flood or eastern stream runs $2\frac{3}{4}$ or 3 hours after high water in the harbour. *See* page 68.

Signal station.—There is a Signal station at Dunkerque: it is just in front of the lighthouse.

Pilots are unable to get out of harbour when there is a heavy sea at the entrance, which is frequently the case; but, three pilot vessels are always cruising at sea. Their stations are, one between Dungeness and the Downs, another near Ruytingen light-vessel, and a third near Dyck light-vessel. They all have the name *Dunkerque* in large black letters on their sail and a large black anchor beneath that name. They always endeavour to meet large vessels, but those in small ones requiring a pilot should make the signal directly they sight a pilot vessel.

Coal is always plentiful and moderate in price, that of French coal delivered on board being about 14s. per ton. Vessels usually coal in the Basins; if they coal alongside the wharf in the tidal harbour, they lie aground in about $8\frac{1}{4}$ feet at low water.

Steam-tugs.—The port is well supplied with steam-tugs, whose services are always available.

A Life-boat is stationed at Dunkerque.

DIRECTIONS.—**From the Westward.**—With the wind from N.N.W. round by West to S.S.W. endeavour to make the land about cape Gris Nez, and, from about 2 miles north-westward of that cape, steer N.E. by E. $\frac{1}{2}$ E. for 10 miles, or until mont Couple bears about S.S.W. and the entrance to Calais S.E. by S. From thence, the course to Dyck light-vessel, at the entrance of West pass into Dunkerque road, is E. $\frac{1}{2}$ S. southerly, 14 miles; this leads about $1\frac{1}{4}$ miles northward of the *red* conical buoy marking the Riden de Calais.

Pass northward of Dyck light-vessel, keep southward of the *black* buoy with a *fixed red* light marking the west end of Snouw bank, and leave all *black* buoys on the port hand and *red* buoys on the starboard hand up to Dunkerque Great road; but, if proceeding eastward beyond the entrance of the harbour to the Little road, it must be

borne in mind that the colour of the buoys is reversed, *red* buoys marking that road on the port hand, if coming from the westward. Vessels of deep draught running in with a strong westerly wind, at low water, should avoid the 21-feet spit which extends 5 cables westward of No. 5 *black* buoy, by keeping over towards No. 10 *red* buoy in this part of the pass. Large vessels, having to wait for high water to enter Dunkerque, anchor in the pass between No. 7 and 9 *black* buoys.

With the wind between N.N.E. and E.N.E., long boards should be made in the Pas de Calais until Calais bears S.S.E. $\frac{1}{2}$ E., when stand in for the land, keeping the lead going quickly to avoid crossing the Riden de Calais. Boards of about 3 miles may be made between West Dyck and the 5-fathoms edge of soundings towards the shore, but, from the meridian of Gravelines lighthouse to the entrance of West pass, short tacks should be made near the edge of these soundings, bearings of Dyck light-vessel should be frequently taken.

At night, with westerly winds, after running past cape Gris Nez as directed, until Calais light bears S.E. $\frac{1}{2}$ S. and cape Gris Nez light S.W. $\frac{1}{4}$ W. westerly, steer E. $\frac{1}{2}$ S. for Dyck light-vessel; passing close northward of it, bring it astern on the bearing W. by N., and so run on through Dunkerque road, anchoring in about 8 fathoms, with Leuquenaert tower light seen between the two jetty lights S.S.E.

From the Northward.—When bound from the North sea to Dunkerque, or other French ports on this coast, endeavour to make the land about cape Blanc Nez whatever the direction of wind or time of tide. The land south-westward of this cape, as far as cape Gris Nez, may be seen in ordinary weather about 18 miles, and mont Couple and the hills around it, 22 or 23 miles.

The course from about 3 or 4 miles eastward of the Galloper light-vessel is S.S.W. $\frac{1}{2}$ W.; this leads eastward of the Four-mile knolls or North Falls head, and when the North Foreland lighthouse bears W. by N. $\frac{1}{2}$ N., steer S.W. $\frac{1}{2}$ S. to pass midway between the Falls tail and the south-western end of Sandettié bank. In clear weather, there is no difficulty in turning to windward over this ground; when thick or foggy, the lead must be kept going quickly to avoid standing into less than 20 fathoms.

From a well defined position, ships may pass between the Great and Little banks of Outer Ruytingen by steering for Gravelines lighthouse bearing S. by E. $\frac{3}{4}$ E. easterly, and taking great care to maintain

that bearing ; the least water in this route is $3\frac{1}{2}$ fathoms, on crossing West Dyck bank. On bringing Dyck light-vessel to bear E. $\frac{1}{2}$ S., proceed as before directed for Dunkerque roads. The same routes may be safely taken at night when the lights are distinctly seen.

At night, the lights at the South Foreland, cape Gris Nez and Calais, may be seen in clear weather when a vessel is midway between the Falls tail and the south-western end of the Sandettie ; from this position, if the wind is from the eastward, Calais light may be steered for, or, if from the westward, the land between Calais and cape Gris Nez ; but, to keep a safe distance from the coast on either of these courses, it is necessary in the former case not to bring cape Gris Nez light westward of S.W. by W., nor Gravelines light eastward of S.E. by E. $\frac{1}{2}$ E. ; and, in the latter, not to bring cape Gris Nez light westward of S.W. $\frac{1}{2}$ W., nor Calais light eastward of S.E. by S. Having attained either of the positions indicated by these bearings, Dyck light-vessel and Dunkerque road may be steered for as before directed from the westward. With strong northerly winds, it is not prudent to approach within 5 miles of the coast, nor to bring Gravelines light eastward of S.E. by E.

With strong northerly winds, vessels sometimes pass westward of the Galloper and the Falls, or between the Galloper and Four-mile knolls and then westward of the Falls, in order to get smoother water. The course from about 2 miles westward of the Galloper is S.W. $\frac{1}{2}$ S., and a run of about 34 miles on that course brings the vessel up to the East Goodwin light-vessel and well southward of the Falls tail ; both cape Gris Nez and Calais lights will then be in sight if the weather is clear.

Entering Dunkerque.—Have good hawsers ready to moor head and stern, anchors clear, and, with a fair wind, a heavy anchor ready to bring up by the stern. All possible sail should be carried to pass quickly through the breakers at the entrance, where fresh northerly winds raise a heavy sea, and the best time then for running in, is, at high water. When within the entrance channel there is no difficulty in reaching the harbour.

Strong winds between N.N.W. and W.S.W. cause a heavy swell at the entrance. At such times, keep close to the West jetty-head and western side of the channel until sheltered by that part of the jetty which is boarded up, as the east-going stream setting through the open pilework runs with great rapidity towards the East jetty. This stream, as before explained (*see* page 68), is at its greatest strength about half an hour before high water in the harbour. With moderate

westerly winds, the most favourable time to enter, if a vessel's draught permits, is, when the stream slackens, or about half or three quarters of an hour after high water in the harbour.

Strong easterly winds, opposing the tide, raise a high sea at the entrance ; with these winds, steer for the East jetty-head, and then run along the eastern side of the channel. When it blows hard between S.S.W. and S.S.E., vessels cannot enter under sail, and the services of a steam-tug are requisite ; but, if preferred, as the sea is then smooth in the road, they may remain there without danger. During light winds, every effort should be made to close with the West jetty-head to avoid being drifted eastward of the entrance by the east-going stream, which runs at its greatest strength outside the jetties the whole of the time large vessels can enter. The best time for those of light draught to run in, is, directly the signal shows sufficient water and before the stream has attained much strength.

Leaving Dunkerque.—Sailing vessels bound westward or to the northern ports of the North sea, either wait for favourable winds or are towed out to positions from which to make sail. The gates of the wet docks are opened one hour before and closed about half an hour after high water. Winds with southing in them are the most favourable for leaving, but on-shore winds, when strong, forbid all egress.

If bound westward, vessels should leave the harbour directly they float if the wind is sufficiently strong to stem the flood stream ; but, with a light wind, they should not start until near the top of high water, and then anchor in the road for the stream to slacken. On quitting West pass, a W. $\frac{3}{4}$ N. course leads northward of the Riden de Calais ; and, when Calais lighthouse bears S.E. $\frac{3}{4}$ S., or cape Gris Nez lighthouse S.W. $\frac{3}{4}$ W., a S.W. by W. $\frac{3}{4}$ W. course leads a safe distance westward of that cape.

If bound northward, and the vessel's draught permits crossing the banks northward of Dunkerque, the entrance channel should be left as early as possible before high water ; but, this passage should never be attempted without a fresh fair wind so as to run quickly over the banks, and it must be borne in mind that there may be quite 4 feet less water in crossing the Braeck bank than in the entrance channel. When clear of the jetties, steer N. $\frac{1}{4}$ W. to get the spire at Petite Synthe on with the guard-house about one mile westward of Dunkerque lighthouse S.W. $\frac{3}{4}$ S. ; then steer N.E. $\frac{3}{4}$ N. with this mark on, crossing in succession the Braeck, Smal, and Breedt banks, until the lead shows that the vessel is near the eastern edge of

the East Dyck bank, when a N.E. by E. course for 35 miles leads between Thornton ridge and Bligh bank. The soundings on this latter course are from 14 to 19 fathoms. A cast of 9 or 10 fathoms may be had on the two narrow shoals between Thornton ridge and Bligh bank.

If the vessel's draught does not permit crossing these banks, leave the harbour as soon as she floats so as to get the full benefit of the east-going stream, and, when outside the jetties, steer through Zuydcoote pass; *see* page 66. When clear of the pass, steer E.N.E. through West deep until Furnes is on with Broers Duin, bearing South, when the vessel will be crossing the narrow shoal joining Smal and Nieuport banks. From thence, a N.E. $\frac{1}{2}$ N. course for 35 miles leads through North channel and clear of all the banks. The only inconvenience in following this course is, the crossing of the tidal stream (about 2 knots) in an oblique direction, which must be allowed for. Ostende light may be seen in ordinary weather until within 2 miles of the southern part of Thornton ridge.

Boundary.—The boundary or frontier of France and Belgium is 7 miles eastward of Dunkerque.

CHAPTER III.

DUNKERQUE TO THE SCHELDE.

VARIATION, $15\frac{1}{2}^{\circ}$ West in 1892.

Decreasing 8' annually.

The **COAST** from the boundary of France and Belgium to Ostende is skirted by sand-hills of varying height, but none are of so marked a character as to distinguish it from the others, and thus to serve as a guide for identifying the shore from the offing. The most useful objects for this purpose are the undermentioned churches.*

Nieuport lies 15 miles East of Dunkerque; the intermediate land is all low, with hummocks of sand along the shore, and several churches appear in the background, Leffrinckoucke church with a spire, Zuydcoote with only a square steeple, Ghyvelde $1\frac{1}{2}$ miles south-eastward of Zuydcoote, with a square tower and to be seen at a distance of 15 miles, Furnes with its two spires of different heights, and Wulpen with one spire, may be easily recognised. Abreast of Furnes is a long white sand-hill, named Broers duin (Brother's down), which is a little more elevated than the adjacent greenish hill, and may be known by its barren appearance. Nieuport has several steeples and windmills, which sometimes appear like a fleet of ships; but the great church tower, which is square with a turret, shows conspicuously among them, also the tower of the market hall and the lighthouse; in clear weather these buildings can be seen 12 to 14 miles.

From the entrance to Nieuport the land trends East for 9 miles to Ostende, the coast being all low sand-hills. In the intermediate space are several churches; Lombartzyde, with a high flat tower,

* See Admiralty charts :—Dover and Calais to Orfordness and Scheveningen, No. 1,406; Dunkerque to the Schelde, No. 1,872.

about one mile north-east of Nieuport ; Westende church has a spire, and Middelkerke a high white tower surmounted by a spire, which shows well above the sand-hills. Mariakerke, with a small tower topped by a short spire, is only now and then visible.

Ostende stands close to the shore, and is very prominent from the offing, from whence it often makes as an island. Among its principal objects are the tall tower of its cathedral, which is surmounted by a short spire ; the lighthouse and the high square tower of the town hall.

Lifeboats.—La Panne, Nieuport, Ostende, Blankenberghe, and Knocke are lifeboat stations.

Middelkerke bank is $3\frac{1}{2}$ miles within the Outer Ratel. It is 5 miles long N.E. and S.W. within the depth of 5 fathoms ; the least water, $2\frac{1}{2}$ fathoms, is about half a mile from the south-western end of the shoal, from whence Nieuport lighthouse bears S. $\frac{3}{4}$ W., distant $6\frac{1}{2}$ miles.

Middelkerke bank is separated from the East Breedt, by North channel, noticed in page 80.

Nieuport bank, lying off Nieuport and abreast the south-western end of Middelkerke bank, is connected by broad and shallow flats with Smal and Stroom banks. It is $6\frac{3}{4}$ miles long E.N.E. and W.S.W. and half a mile wide ; it is an almost continuous narrow ridge of less than 3 fathoms, the least water being 13 feet. From the south-western end of the shoal Nieuport lighthouse bears S.E. $\frac{1}{4}$ E., distant 4 miles.

Ostende bank, within Middelkerke bank, has from the depth of 5 fathoms at its south-western end, Ostende lighthouse bearing S.E. by E. $\frac{1}{4}$ E. distant 7 miles, and from this point the bank trends N.E. by E. $\frac{1}{4}$ E. for $6\frac{1}{2}$ miles to a well defined termination in 5 fathoms. From the shoalest spot on the bank on which there are 15 feet water, Ostende lighthouse bears S.S.E. $\frac{3}{4}$ E., distant $4\frac{1}{2}$ miles. The north-eastern portion of the shoal has 3 fathoms over it, but over a considerable breadth $3\frac{1}{4}$ to $3\frac{1}{2}$ fathoms may be reckoned upon.

Caution.—A heavy breaking sea rolls over Middelkerke and Ostende banks during northerly gales, and, it is said, alters the position and depths of the shoal patches.

Stroom bank, which protects Ostende Inner road, and assists in defending Nieuport road to the northward, is a dangerous one, and extends the entire distance between Nieuport and Ostende. From its western end, which is separated from Nieuport bank by North-east channel, which is only half a mile wide, Nieuport pier bears

S.S.W. distant $2\frac{1}{2}$ miles, and from thence, the general direction of this shoal is E. $\frac{3}{4}$ N. for 12 miles, the distance between it and the coast decreases gradually, and its eastern end is only separated from the shore flat by a narrow channel, with $2\frac{1}{2}$ fathoms water in it.

The summit of the bank, which is narrow and subject to change, has, eastward of the meridian of Middelkerke, a general depth of 9 feet over it at low water; this shallow and dangerous portion extending to 3 miles eastward of Ostende piers, which it approaches to within three-quarters of a mile. To the westward of the meridian of Middelkerke the depths are from 10 to 12 feet, with the exception of one spot with only 6 feet water on it, from which Middelkerke church bears S.E. $\frac{1}{2}$ S. The south side of the shoal is steep, and consequently dangerous, but when this has been cleared, the depths towards the shore will be found regular.

Buoy.—The western part of the Stroom bank has been dredged. A *black* and *white* horizontally striped buoy, carrying a *fixed white* light, is moored at the south-east extreme of the new pass, and inside Stroom bank at $3\frac{1}{2}$ miles westward of Ostend.

Wenduyne bank begins about $2\frac{1}{2}$ miles eastward of Ostende bank, and lying nearly parallel to the shore extends to abreast Blankenberghe, or about $7\frac{1}{2}$ miles. The western end of the bank, which partly shelters Ostende Outer road to the north-eastward, has from $2\frac{1}{4}$ to 3 fathoms upon it, but the shallow part has 12 feet over it, from whence the water gradually deepens towards its eastern end, where, in 3 fathoms, Blankenberghe church bears S.S.E. $\frac{3}{4}$ E., distant $2\frac{3}{4}$ miles.

A buoy with *red* and *white* vertical stripes, and surmounted with a *white* ball, is anchored in $3\frac{3}{4}$ fathoms on the outer side of the north-east end of Wenduyne bank, at $3\frac{1}{2}$ miles N.N.W. $\frac{1}{2}$ W. from Wenduyne church.

NIEUPORT ROAD and WEST DEEP, directly opposite Nieuport, is bounded on its inner side by Broers sands and the flat bordering the coast; by the Traepegeer to the westward; Nieuport bank, and Smal bank adjoining it to the northward; and by Stroom bank to the eastward. The road including West deep, with $3\frac{3}{4}$ to 9 fathoms in it, over good holding ground of mud and sand, is for the most part one mile wide as far as North-east channel, where it narrows to half a mile; and considering its eastern boundary to be in the line of Nieuport tower and the entrance of the port, West deep is between 7 and 8 miles long.

There are four passages into Nieuport road, but, enclosed as it is by banks, they can only be used at low water by small vessels. That from the westward is in continuation from Dunkerque road; that from the northward through North channel; that from the north-eastward through North-east channel, between Nieuport and Stroom banks; and that from the eastward is the Eastern channel, between Stroom bank and the shore in continuation of Ostende Inner road.

Fishing lights.—At La Panne a *fixed green* light is exhibited for fishing boats from a stand on a sand-hill. It is 49 feet above high water, and visible 5 miles.

At Oost Dunkerque a *fixed white* light for fishing boats is shown on a sand-hill, at an elevation of 41 feet above the sea, and is visible 5 miles.

Directions.—When proceeding to Nieuport road from Dunkerque road, which is the best manner of approaching it, it is necessary to use Zuydcoote pass, page 66. It is only at high water (and in a sailing ship with a fair wind) that this pass can be used by vessels of large draught, but it is available at low water to those drawing less than 16 feet. The leading mark is the great steeple at Bergues, appearing westward of Leffrinckoucke church, bearing S.S.W. $\frac{1}{2}$ W., but should the weather be hazy, then use Zuydcoote (Sables) old tower, bearing S. by W. $\frac{1}{4}$ W., as the channel mark, which, however, crosses the tail of Traepegeer bank.

The channel has a depth of from 17 to 22 feet at low water. When passing through, it is necessary to be cautious of the spit of the Traepegeer, which has from 6 to 9 feet upon it, and extends to within two-thirds of a mile of the south-east *red* buoy upon the Hils. See caution on page 66. Having entered West deep, Smal bank must be approached with great caution, as it is extremely steep and dangerous N. by E. $\frac{1}{2}$ E. of Sables tower. It will, therefore, be prudent when out of the pass and the water deepens to 7 fathoms to steer E. by N., and having run 8 miles the vessel will be abreast Nieuport.

Anchorage may be taken up with the jetty at Nieuport bearing S.E. $\frac{1}{4}$ E., distant $2\frac{1}{4}$ miles, in a depth of 6 to 7 fathoms, sand and mud. A small vessel may go nearer to the jetty and anchor in from 23 to 26 feet.

The approach to Nieuport road from the northward being through North channel and over the flat which joins Smal and Nieuport banks, is but little frequented on account of the distance

of the passage off shore, rendering it difficult to distinguish objects that may be used as marks. Vessels sometimes leave the road by it with a fair wind and at the top of a spring tide, and then it is usual to cross the western part of the Nieuport bank with Nieuport lighthouse in line with Templars tower S. by E. $\frac{1}{2}$ E. easterly, and when the water deepens then steer out by North channel. In this case, Middelkerke bank need not be regarded, if the water be smooth.

North-east channel, between the Nieuport and Stroom bank, has a depth of 4 fathoms in it, but is comparatively narrow, and is the only passage between Ostende Outer road and Nieuport road. From the Outer road with Ostende bearing S.S.E., steer W. by S. $\frac{1}{2}$ S. for 8 or 9 miles, passing the 3-fathoms tail of Stroom bank, until Nieuport tower and beacon appear in line; but this channel is unsafe to a stranger.

Eastern channel is within Stroom bank, and connects Nieuport road with Ostende Inner road. When using this passage, care must be taken to avoid the southern edge of Stroom bank which is steep, but towards the south side of the channel the depths are regular. Vessels of large draught may sail at a proper time of tide from Nieuport small road to the Schelde, through this channel, or by the North-east channel through Ostende Outer road.

NIEUPOORT is near the outlet of the Yser. Its population, amounting to about 3,000, is principally employed in brewing, distilling, the manufacture of rope and sail-cloth, shipbuilding, and fishing. There is railway communication with Ghent. The harbour is small, and only fit for small craft.

Depth on the bar.—The entrance to the channel is sheltered by two pile piers or jetties, and upon the bar, which is one cable outside the jetty head, there is a depth of one foot at low-water springs, and 17 feet at high water springs.

There are from 18 to 20 feet water at a quarter of a mile from the jetty heads; further in the depth decreases very quickly to the bar.

Directions.—No vessel should attempt to enter Nieuport without a pilot, unless forced to take the harbour without such assistance, when, enter between the pier heads; then keep in the channel as nearly as its direction can be made out, passing close to the poles which are placed in the concaves of the banks on either side, where the deepest water is, and on arriving at the remains of an old boom, if no pilot is ready, lay the vessel upon the sand on the western side, which may be done with safety.

In consequence of the volume of water which pours out from the sluices at Nieuport, the current which sets out of the harbour is sometimes very strong, especially after high water.

LIGHTS.—Nieuport light is a *fixed red* light, visible through an arc of 216° , or between the bearings N. 53° E. and S. 89° W.; it is elevated 98 feet above high water, and in clear weather should be seen from a distance of 14 miles. The lighthouse is octagonal in shape, and erected on the sand-hills eastward of the harbour.

East pier.—The light on the East pier is *fixed red*, visible between the bearings N. 80° E., through east and south to S. 80° W. it is 26 feet above high water, and in clear weather should be seen from a distance of 5 miles.

West pier.—The light on the West pier is *fixed green*, visible between the bearings N. 64° E., through east and south to S. 64° W., and in clear weather should be seen from a distance of 4 miles.

TIDAL SIGNALS.—Day signals showing the depth of water on the bar, are made from a flagstaff placed to the westward of the harbour and eastward of the Nieuport baths as follows :—

A yellow and blue pennant at the mast-head...	6 to 8 feet water.
" " at half-mast.....	8 " 10 "
A blue pennant at the mast-head.....	10 "
" " at half-mast	11 "
A blue flag at the mast-head.....	12 "
" " at half-mast	13 "
A white flag with blue cross at the mast-head	14 "
" " at half-mast	15 "
A red flag at the mast-head	16 "
" " at half-mast	17 "
A blue pennant at the mast-head, white flag under it.....	18
A blue pennant at the mast-head, red flag under it.....	19 "

Night signals.—The undermentioned signals, indicating the height of the tide, are shown at the western side of the port.

A <i>white</i> light indicates	8 feet water.
" " with one <i>green</i> flash	9 "
" " " two " flashes ...	10 "
" " " three " " ...	11 "
" " " four " " ...	12 "
" " " one <i>red</i> flash	13 "

A white light with two red flashes	14 feet water.
" " " three " "	15 "
" " " four " "	16 "

Each series of flashes is produced *every eighty seconds*, and each flash is shown *every five seconds*, visible in clear weather from a distance of 5 miles.

Pilots.—A cutter pilot boat with the name *Nieuport* on the mainsail, cruises off the port and to a distance of 14 miles.

Lifeboats.—There are two lifeboats with a life-saving apparatus at Nieuport.

Tides.—It is high water, full and change, at Nieuport, at 0h. 18 m ; springs rise 16 feet, and neaps 13 feet.

OSTENDE OUTER ROAD, situated outside Stroom bank, and protected by the Nieuport, Ostende, and Wenduyne banks, is 5 miles long, east and west, and one mile wide, with a depth of 5 to 6½ fathoms over a bottom of sand and ooze. It is the anchorage for large vessels waiting wind or tide to enter Ostende harbour. The anchorage is about 2¼ miles off shore with Ostende cathedral bearing S.S.E. ¼ E.*

There is good holding ground in 11 fathoms, fine sand and mud, with Ostende bearing about S. by E. ½ E. distant 7 or 8 miles. In this latter anchorage the Ostende pilot boats are to be found in bad weather, especially when the wind is from the northward.

Directions.—The outer road is generally entered either from the direction of the Schelde within Wenduyne bank, or from the north-west between Middelkerke and Nieuport banks and Ostende bank. For the latter route the mark is the steeples of Oost Dunkerque and Furnes in line bearing S.W. by S., until Ostende lighthouse bears S.E. ¾ E., which latter bearing will then lead into the road.

At night, after having sighted Ostende light, which may be seen at a distance of 20 miles, it will be prudent to heave to, and stand off and on, or to anchor outside the banks, and wait for daylight. Vessels, however, of 15 feet draught and under, may, when the water is smooth, cross the north-east tail of Ostende bank and the west tail of Wenduyne bank, and enter the Outer road, with Ostende light bearing S. by E. ½ E. The least known depth in this track is 3¾ fathoms.

* See Admiralty plan :—Ostende road, No. 125 ; scale, $m = 3.5$ inches
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Caution.—Easterly gales are comparatively harmless to vessels at anchor in the outer road, but it is necessary to guard against those from the westward or south-westward ; with such it will be better to weigh and gain an offing without loss of time, or, if the wind be from the north-westward, to run for the Schelde. For this purpose, make good an East course for 10 miles, so as to pass within and well clear of Wenduyn bank, and when abreast Blankenberghe, steer to the N.E. for Wielingen channel light-vessel.

OSTENDE INNER ROAD, comprised between Stroom bank and the shore, has but indifferent holding ground, especially in the neighbourhood of the harbour, and it should not, therefore, be used in bad weather.

Directions.—When approaching this road from the offing, Stroom bank may be crossed by small vessels to the westward of Ostende at half flood. The western end of the bank may be passed in 10 to 11 feet at low water, with Westende church S. $\frac{1}{2}$ W., southerly. Vessels generally cross the Stroom well to the westward, so as to have the advantage of going with the flood when entering Ostende harbour. The shore opposite Westende is shallow for nearly a mile ; but the flat becomes narrower and steeper towards Ostende. In the western part of the road the depth is 4 or 5 fathoms, which continues as far as Raversyde ; it then shallows gradually, and off Ostende there are not more than from 19 to 21 feet.

Vessels under 12 feet draught, bound to either of the roadsteads of Ostende, and waiting for tide to cross the banks, will pass clear of all dangers at an offing of from 6 to 7 miles, anywhere between Nieupoort and Blankenberghe. In foggy weather the navigator will know whether he is eastward or westward of Ostende by the nature of the bottom, which, near the shore and to the eastward of the harbour is muddy and rather sticky ; whereas, at and beyond one mile to the westward the bottom is hard sand.

OSTENDE being an important position, the fortifications, with the promenade in front, named the Digue, command attention from the roads. Ostende is much frequented for sea bathing ; it is connected by railway with France and Germany ; and steamers ply to Havre and London. The mail packets run regularly three each way to and from Dover, every day of the week Sundays included.

The harbour, which is an artificial work, skirts the east side of the town, its outlet is defended on both sides by open timber piers 700 yards long, the channel being 500 feet wide at the pier heads, narrowing to 360 feet inside. It forms the sea-terminus to the

numerous canals, which stretch from hence into the interior of the country ; the canal from Ostende to Ghent is upon a large scale, and available to vessels of considerable burden.*

There is every accommodation for discharging and loading into railway trucks alongside the quays.

Ostende contained, in 1891, 24,712 inhabitants. There is a large fishing trade ; foreign fishing boats enter free of charges.

A telegraph cable extends from Ostende to the South Foreland.

Depth at the entrance.—The bar has been removed by dredging and vessels of 23 feet draught can enter the port of Ostende at high water neaps, and of 12 feet draught at low water springs. The heaviest draught vessel that has visited the port was of 21 feet 2 inches draught (July 1892). The depth is much influenced by the prevailing winds, the depth being less after a succession of north-easterly winds.

Wet docks.—Premier Bassin is 918 feet long, 197 feet wide, 39 feet wide at the entrance, and has a depth of 18 feet. Deuxième Bassin is 557 feet long, 328 feet wide, 49 feet wide at entrance, and has a depth of 18 feet. For dimensions of tidal basins, &c., see Dock book.

LIGHTS.—The light-tower at Ostende, stands 820 yards E. by S. of the north-east corner of the town, on the eastern side of the entrance to the harbour. It exhibits a *fixed white* light, which is visible from seaward when bearing between N. 41° E., through south to S. 86° W. It is elevated 187 feet above high water, and visible in clear weather from a distance of 20 miles.

A *fixed green* light upon the western pier head is shown at an elevation of 25 feet, and is visible 5 miles, and a *fixed red* light on the eastern pier head, visible 5 miles.

Fog signals.—A gun is fired *every ten minutes* from the battery on the east pier, and a bell is sounded in the interval.

In addition to the above, two guns are fired in succession *every five minutes* when the Dover packet is due.

TIDAL SIGNALS are shown as follows, and indicate the depth of water at the entrance of the dock, the sill of which is 5 feet below low water springs :—

By day the signals are made by flags, pennants, and a ball at the signal-mast on the north dike of the town.

7 feet.....*Blue* pennant half-mast.

8 „*Blue* pennant at masthead.

*See Admiralty plan :—Ostende road, No. 125 ; scale, $m = 3\cdot5$ inches.

- 9 feet.....*Black* ball half-mast.
- 10 „*Black* ball at masthead.
- 12 „*Blue* flag half-mast.
- 14 „*Blue* flag at masthead.
- 16 „*Black* ball over *blue* flag.
- 17 „*Blue* flag over *black* ball.
- 18 „*Blue* flag over *red* pennant.
- 19 „*Red* pennant over *blue* flag.
- 20 „*White* flag with *blue* cross.
- 21 „*White* flag with *blue* cross with ball above.
- 22 „*Red* flag.
- 23 „*Red* flag with ball above.
- 24 „*Red* flag with *red* pennant under.

By night, the signals are made by *red*, *white*, and *green* lights from the battery on the eastern jetty.

- 7 feet.....*Green* over *red*.
- 8 „*Green* over *green*.
- 9 „*Red* over *red*.
- 11 „One *red*.
- 14 „One *green*.
- 16 „One *white*.
- 17 „*White* over *green*.
- 18 „*White* over *red*.
- 19 „*White* over *white*.
- 20 „*Red* over *white*.
- 21 „*Green* over *white*.
- 22 „*Red* over *green*.
- 23 „*Red* above, *green* in middle, *white* under.

Pilots for Ostende are obtained from one or other of the pilot vessels which cruise about ; these vessels are yawl-rigged, they carry a *blue* flag, with the number of the boat in *white* on it at the mast-head, and have the name Ostende surmounted by the letter P. on the mainsail.

One vessel is stationed to the westward and cruises between Middelkerke and Ostende not further than 10 miles off shore, another between Ostende and Wenduyn not further than 8 miles off shore. In stormy weather they are outside the banks. See page 83.

The Antwerp pilot vessels supply pilots to conduct ships through the banks until within the range of the Ostend boats, for which service there is a fixed charge.

Lifeboats.—There are two lifeboats stationed at Ostende, one on each side of the harbour entrance, also a life saving apparatus.

Tugs may be called by hoisting two flags one above the other.

Repairs and refitting in all branches of shipbuilding can be effected. There is a crane capable of lifting 25 tons, and movable cranes at the sides of the docks.

Coal.—Generally about 1,000 tons of coal is available for steam-vessels.

Directions. — As the stream runs eastward for about three hours after it is high water in Ostende harbour, those intending to enter should keep to the westward until there is sufficient depth for their purpose.

The course in is S.S.E. Should the wind be from the northward, and a vessel be forced to run for the harbour without a pilot, great caution must be observed with respect to the easterly set of the flood stream across the harbour's mouth. The ebb sets to the westward until two hours after low water. Having entered rather over on the west side, then keep along the eastern jetty to its inner end, when the vessel can be warped to a convenient berth.

When a vessel approaches the entrance of the harbour without a pilot on board, or the state of the sea will not allow one to go out, a pilot will place himself on the eastern jetty and show by means of a flag the direction that the vessel must follow.

By night the *white* light from the lighthouse, and *red* light on the eastern pier kept in line S.E., will lead clear of the west pier-head, and into the entrance, when proceed as before directed.

Tides and tidal streams.—It is high water, full and change, at Ostende at 0h. 25m. ; springs rise 17 feet, and neaps 13 feet. Strong N.N.W. winds have the effect of raising the level considerably, whilst those from the eastward decrease it.

The flood or east-going stream outside the harbour runs about three hours after high water, and the ebb or west-going stream runs two hours after low water, quite two knots at high water.

The COAST in continuation from Ostende bounds the outlet of the Schelde to the south-westward. It has a general E. $\frac{1}{2}$ N. direction, and presents the same features as that already described, being low sandy, and with but few objects to assist in identifying it from the offing. At 3 miles eastward of Ostende are some sand-hills named Spaniard duin, which are more elevated than the others, and there is another sand-hill very apparent between there and Wenduyn.

Wenduyne church, $7\frac{1}{4}$ miles from Ostende, has a large white tower, and the sand-hills in front of it are above the average height.

BLANKENBERGHE stands close to the shore at 9 miles from Ostende, and there are generally numerous boats and bathing machines upon its beach. The port is westward of the town and the entrance is between two pile jetties, between which and on the bar there are only 2 to 3 feet water at ordinary low tides. There is but one basin, which dries 6 feet. The tower of the church is terminated by a short spire or peaked roof, known among sailors by the term 'bluff,' in order to distinguish it from the common square tower, as well as from the spire. Blankenberghe is further marked by several windmills, and the two lofty steeples of Bruges will generally be seen inland of it; the port is connected by rail with Bruges and Heyst.

Lifeboat.—Blankenberghe is a lifeboat station.

LIGHTS.—At Blankenberghe a *fixed white* light is shown from an octagonal stone lighthouse eastward of the port and in line with the houses built on the sea-dike. It is elevated 83 feet above high water, and is visible at a distance of 12 miles.

A *fixed green* light for fishing vessels, elevated 26 feet above high water, and visible for 4 miles, is exhibited from an iron stand on Blankenberghe western harbour mole.

Wet dock.—This dock at Blankenberghe is 787 feet long, 328 feet wide, and has a depth of 14 feet.

Heyst church has a long nave, and a tower with a sharp roof. The Leopold canal is entered from the shore about half a mile west of Heyst lighthouse, from which is exhibited a *green* light for fishing craft, and is visible 6 miles.

Kadzand island, which with Walcheren island forms the entrance of the Schelde, is about 11 miles long, and low like the rest of the coast, but with several churches and mills. Groede church, near the middle of the island, has a telegraph upon it.

Knocke.—The downs of this name are north of the village, a *fixed white* light is shown from a square tower 68 feet high on the keeper's dwelling. The light is 87 feet above high water, and can be seen 12 miles in clear weather.

Knocke church has a white tower with a stunted spire and spindle, and there is a watchhouse and flagstaff upon the sand-hills north-eastward of it.

Boundary.—The boundary between Belgium and the Netherlands on the shore of the North sea, is at Sluis gat, 10 miles eastward of Blankenberghe ; but the town of Sluis is in the Netherlands.

The SCHELDE, or Scheldt, one of the most important rivers of the Netherlands, takes its rise in the French department L'Aisne, traverses a part of France, East and West Flanders, and flowing by Ghent, receives the navigable waters of the Lys and two large canals : it then turns easterly to the province of Antwerp, and then northerly between that province and East Flanders. At Antwerp, the Schelde is a quarter of a mile wide, and in places has upwards of 7 fathoms water ; abreast the lower part of the city it forms a capacious and secure harbour, fitted for the reception of large ships. About 15 miles lower down, the river divides into the East and West Schelde ; the former runs round the eastern and northern sides of Beveland island, and south of Schouwen island, to the sea. The latter branch, which is the main stream, flows westerly between the mainland of Dutch Flanders on the south, and the Beveland and Walcheren islands on the north, and joins the sea below Flushing. The whole course of the Schelde is 211 miles, and its mouth being directly opposite the Thames, gives to it both naval and commercial importance.*

Ice obstructs the navigation of the Schelde in severe winters. In December, 1890, floating ice was so abundant that wooden vessels could not navigate the river to Antwerp ; steamers drawing more than 21 feet were not allowed to proceed up the river above Flushing.

PILOTS.—Vessels are stationed at the mouth of the Schelde to supply Belgian pilots to ships bound to Antwerp or Ghent via Terneuse canal. These vessels bear the following distinguishing marks :—The name *Antwerpen*, surmounted by the letter P, painted in black letters on both sides of the sail, as also the number of the boat ; at the masthead a *red* flag, on which is the number of the boat in *white* figures, and on the stern of the boat the words *Bateau Pilote*, and the number. Each pilot is invested with a medal showing his station, grade, and number, and is also furnished with instructions for the guidance of masters of vessels, printed in the English, French, Dutch, Danish, German, Spanish, and Italian languages.

* See Admiralty chart :—River Schelde, from sea to Antwerp, No. 120 ; scale, $m = 1\cdot0$ inch.

The Dutch pilot vessels for the mouth of the Schelde are schooners and yawls. The name *Vlissingen* and the number of the vessel are painted in *black* on the mainsail; and a *blue* flag is carried at the masthead, on which is painted in *white* the number of the vessel. By night they hoist a *white* light, and show a flare above the bulwark every quarter of an hour.

Should all the pilots from a pilot vessel be employed, the *blue* flag by day, and the flare at night, are not shown.

The vessels cruise off Dungeness; off the Wielingen channel; and within the Steen bank, off the East Schelde.

Navigable depths.—A vessel of 30 feet draught, by day, and of 26 feet, by night, can navigate the channel from sea to Antwerp at high water neaps; and of 15 feet draught, by day, and of 13 feet, by night, at low water springs. The heaviest draught vessel that has visited Antwerp was of 28 feet draught (1890).

Vessels drawing 15 feet can reach Termonde, 44 miles from Antwerp.

The depth of water in the channels of the Schelde is constantly varying.

In June 1892, the following were the least depths at low water observed in the channels of the West Schelde.

On the outer bar of Deurloo channel $14\frac{3}{4}$ feet, with a rise of $10\frac{1}{2}$ feet.

East gat, 23 feet, with a rise of $10\frac{3}{4}$ feet.

Everingen pass, $21\frac{3}{8}$ feet, with a rise of $12\frac{3}{4}$ feet.

Rug-Van Baarland, 31 feet, with a rise of 13 feet.

Rug Van Bath, $26\frac{1}{4}$ feet, and Zuider gat, 19 feet, with a rise of $13\frac{1}{4}$ feet.

A vessel of 30 feet draught can enter the Outer or Railway harbour at Flushing at high water neaps, and of $20\frac{3}{8}$ feet draught at low water springs. The heaviest draught vessel that has visited Flushing was of $23\frac{3}{4}$ feet. Vessels up to $23\frac{1}{4}$ feet draught can pass through the locks, and navigate the canal through Walcheren.

Directions for approaching the Schelde.—Those from Dover strait bound to the Schelde, generally steer such a course from the back of the Goodwin as to pass between the West Hinder and the north-eastern end of East Dyck or Clif d'Islande banks, and thus, northward of all the Flemish banks, which gives them a clear approach to Wielingen channel.

The lead should be carefully attended to, and after passing Ostende the shore should not be approached into less than $3\frac{1}{2}$ fathoms water, as the Wenduyn is shallow, and is steep on the outer side.

If from near cape Gris Nez, and intending to pass outside the banks, steer to pass $2\frac{1}{2}$ miles N.W. of the 3 fathoms upon the Sandettié, and to lat. $51^{\circ} 22' N$. Keep on that parallel, which is to the northward of all the banks, and passing over 7 or 9 fathoms upon the south-west tails of Fairy and West Hinder banks, to abreast West Hinder light-vessel, when proceed as before.

Or, having clear weather, smooth water, and daylight, with cape Blanc Nez bearing S. by W. $\frac{3}{4}$ W., distant about 10 miles, steer to pass 2 miles S.E. of the Sandettié; $1\frac{1}{4}$ miles N.W. of the Bergues buoy, and to the position between the West Hinder light-vessel and the East Dyck before mentioned; then keep to the eastward for 25 or 26 miles upon the same parallel ($51^{\circ} 22' N$.), or a little more northerly, so as to avoid the north-east extremities of the banks, up to Wandelaar light-vessel, and on to Wielingen light-vessel.

Approaching the Schelde from the direction of Ostende, keep about $1\frac{1}{2}$ miles off shore, and in not less than $3\frac{1}{2}$ fathoms, until Bruges steeples appear in line with Blankenberghe, then steer N.E. by E. into Wielingen channel and on towards the Wielingen light-vessel.

Schooneveld anchorage.—At this anchorage in the offing abreast Wielingen channel there are from $4\frac{1}{2}$ to 9 fathoms water, on good holding ground. Those proceeding westward of Schooneveld bank, for Wielingen channel, may anchor in 5 or 6 fathoms, with Westkapelle bearing East, and Bruges steeples about midway between Blankenberghe and Lisseweghe steeples, about S. $\frac{1}{4}$ W.

Tugs.—In the Schelde tugs will be found to tow vessels up to Antwerp, and in fine weather with easterly winds they cruise as far out as the Hinder light-vessels.

Tides and tidal streams at Schelde entrance.—At Blankenberghe it is high water, full and change, at 0h. 15m., at Flushing and Veere at about 0h. 54m., and at Antwerp at 4h. 25m.

The average rise at Flushing is 11 feet at neaps, and at springs 15 feet; but it is much affected by the strength and duration of different winds.

Without any material error the rise of the water, at ordinary neap tides, may be stated thus:—

Rise.				Fall.			
ft. in.				ft. in.			
During the 1st hour of flood	-	0	11	During the 1st hour of ebb	-	0	10
" 2nd	"	1	3	" 2nd	"	-	1 7
" 3rd	"	-	1 7	" 3rd	"	-	2 4
" 4th	"	-	2 3	" 4th	"	-	2 10
" 5th	"	-	4 0	" 5th	"	-	2 7
" 6th	"	-	1 10	" 6th	"	-	1 8

From this it appears that the greatest rise occurs at the 5th hour, and the greatest fall at the 4th hour.

On this part of the coast the tides are very irregular when compared with what has been observed further north on the Netherlands coast; here, for instance, they revolve in a direction opposite to the sun, whereas, northward of the Oude Steen bank of Goeree they follow its course. The different directions which the streams take from hour to hour, are, nevertheless, of such importance to a vessel running in among the banks, or making for a harbour (the reaching or not reaching of which may entirely depend on this knowledge), that a concise description of them will here be given.

In order to have a general point of reference, the time of high water at Flushing will be found the best adapted for the purpose. By reckoning in the usual manner, it may be ascertained how many hours have elapsed since the last high water there at the time designated.

Outside the banks, in the open sea, the general flood-stream runs E.N.E., and the ebb W.S.W. There, as well as outside the gats, or entrances to the channels, the after-flood, as it is called, begins two hours before it is high water at Flushing, and runs about E.S.E. for the Walcheren coast, until it is high water. The stream then bends away from the coast, so that, at one hour after high water, it will have a N.E. direction; at two hours after high water at Flushing it will run N.N.E.; and at the third hour after high water, or at half-ebb at Flushing, North. The rotation then accelerates till the fourth hour, when it attains a W.N.W. direction, at which time it is said to be low water at sea.

During the following two hours, that is, till the time of low water at Flushing, it is slack water on Steen bank and off the gats, and the stream runs W.S.W.; so that from the beginning of the ebb at sea, until the next high tide, the stream will have varied in direction 16 points of the compass, against the sun.

With the flowing tide the rotation follows the same order, so that at the seventh hour after high water (always at Flushing) the stream runs S.W.; at the eighth, S.S.W.; at the ninth, South; at the tenth, E.S.E.; at the eleventh, East; and at the twelfth hour, or second high water, E.N.E. again; having thus, during the six hours of the flood, run successively towards the remaining 16 points of the compass, against the sun; so that a vessel at anchor, in a calm, would, in the course of the ebb and flood tides, have swung to all the points of the compass; but it is proper to remark that the stream changes its direction quickest near the entrance of the gats.

Though the same rotary movement takes place on the Steen bank, yet just within it, in Steen deep, the streams run more regularly, preserving an E.N.E. and W.S.W. direction, with an interval of slack water between them ; which is not the case with the above revolving streams, as they continue to run without intermission.

LIGHTS.—Wandelaar light-vessel is moored in 5 fathoms about half a mile S.W. from Wandelaar buoy, and $8\frac{1}{4}$ miles W. $\frac{2}{3}$ N. from Wielingen light-vessel.

The light is *flashing white*, showing *one flash every five seconds*, elevated 34 feet above the sea, and should be visible in clear weather from a distance of 11 miles. A riding light is also shown.

The light-vessel (iron) is painted *red* with *black streak*, has the name *Wandelaar* in white letters on the sides ; and by day, two baskets, coloured *red* and placed vertically, are carried at the masthead.

NOTE.—When from any cause, the *flashing light* cannot be exhibited, a *fixed white* lantern light will be shown from the masthead, and a *white* flare every ten minutes from above the gunwale.

When the light-vessel is not in station, the usual lights will not be exhibited, but three fixed lantern lights (upper *white* and the others *red*), placed vertically, will be shown. By day, a *red* flag will be hoisted at the masthead. Should the light-vessel be in need of assistance, by day, the signal flags N.C. of the International Code “*In danger, have need of help*” will be hoisted ; and at night, besides the above-mentioned lights, a *fixed white* light will be shown from the stern, and a *red* rocket will be fired every fifteen minutes.

Fog signal.—A siren, gives *two* short blasts in succession *every two minutes*. Should it not be possible to work the siren, a bell will be sounded *twice* in succession *every two minutes*.

Wielingen light-vessel.—The light-vessel, for leading through Wielingen channel, is moored in 5 fathoms, with Nieuwe Sluis lighthouses in line, and Bruges and Heyst church towers in line. The light apparatus is on the mainmast ; by day a *red* ball is carried at the masthead ; the vessel also has a jigger mast. The vessel is painted in *red* and *white* horizontal streaks, with *Wielingen* in white letters on the sides.

The light shows a *red flash of fifteen seconds* duration *every half minute* ; it is elevated 39 feet above the sea, and should be visible in clear weather from a distance of 9 miles. A riding light is also shown.

NOTE.—When from any cause, the *flashing* light cannot be exhibited, a *fixed red* lantern light will be shown from the masthead, and a *white* flare every five minutes from above the gunwale. When the light-vessel is not in station, the usual lights will not be exhibited, but *three fixed* lantern lights (upper *red* and the others *white*), placed vertically, will be shown. Should the light-vessel be in need of assistance, in addition to the above-mentioned lights, a *fixed white* light will be shown from the stern, and a *red* rocket will be fired every fifteen minutes.

Fog signal.—A siren gives *three* short blasts *every two minutes*; if it is out of order, a bell will be similarly sounded.

East gat lighthouse is of iron, red, circular, and lies N. by W. $\frac{1}{4}$ W. distant 1,530 yards from Westkapelle lighthouse. The light is a *fixed white* light visible seaward between the bearings S. by W. and N.E. by N., elevated 59 feet above high water, and should be seen in clear weather from a distance of 13 miles. This light in line with Westkapelle light S. by E. $\frac{1}{4}$ E. leads between the Steen banks to the East gat.

Westkapelle light is a *fixed white* light, shown from a lantern, surmounting the square, red tower of Westkapelle, at the west end of Walcheren. It is elevated 146 feet above high water, and in clear weather is visible 18 miles. This light is obscured when bearing westward of S. by W. $\frac{1}{2}$ W. to clear Banjaard banks.

Domburg is a *fixed* light, showing *red* between the bearings S.E. $\frac{1}{8}$ E. and E. by S. $\frac{1}{8}$ S., and *white* southward of E. by S. $\frac{1}{8}$ S., it is exhibited on a high duin near Domburg to mark the termination of the leading lights, or where they must be abandoned on entering East gat.

Zoutelande light is *fixed white*, $1\frac{3}{4}$ miles, S. by E. $\frac{1}{2}$ E., from Westkapelle light, it is exhibited from a building on the sand-hills, which is elevated 46 feet above high water, and can be seen 12 miles between the bearings North to N.N.W. $\frac{1}{2}$ W.

Kaapduinen :—Two *fixed white* lights are exhibited on the sand-hills 2 miles S.S.E. from Zoutelande, they bear N.W. by N. and S.E. by S. from each other at 126 yards apart, the northern is elevated 47 and the southern 90 feet, and should be visible 10 or 12 miles between the bearings S. by E. $\frac{3}{4}$ E. to S.E. $\frac{1}{2}$ E.

The Kaapduinen lights, also, that at Zoutelande, are leading lights for the navigation of East gat.

Flushing.—West bastion light is a *fixed* light elevated 49 feet above high water, and shows *red* from the bearing S.S.E. $\frac{1}{4}$ E. to E. by S. $\frac{1}{2}$ S., over Nolle plaat; *white* from E. by S. $\frac{1}{2}$ S. to North; *green* from North to N.W. $\frac{3}{4}$ W., over Flushing road; *white* from N.W. $\frac{3}{4}$ W. to (approximately) W. by N. $\frac{3}{4}$ N.; and again *red* from W. by N. $\frac{3}{4}$ N. to the shore. The white light should be visible in clear weather from a distance of 12 miles, the red light 6 miles, and the green light 3 miles.

The light support is an iron pentagonal frame work, 31 feet high, with a reddish brown house.

On the west jetty head of the canal harbour, a *fixed green* light is exhibited, visible 4 miles. From the east jetty head a *fixed green* light is shown, which is also visible for 4 miles.

A *white fixed* light is shown from the east side of the railway port, visible 10 miles.

NOTE.—When the canal harbour is inaccessible, the *green* lights are not exhibited, but a *red* light is shown on one of the moles. The *green* and *red* lights seen at the same time indicate that the harbour is not accessible for vessels drawing over 19½ feet. By day the *red* light is replaced by a *red* flag and the *green* light by a *green* flag.

Fog signal.—A fog signal is established at the west mole. The signal is a horn, worked by steam and compressed air, which during thick or foggy weather will give a blast of *eight seconds* duration *every forty seconds*.

Nieuwe Sluis:—Three lights are shown on the embankment at the north end of Kadzand island, or at the south entrance of the river; the eastern two are *fixed white* lights, 1,110 yards apart, W. by N. and E. by S. The upper is elevated 83 feet and is visible 14 miles seaward between the bearings S.E. by E. $\frac{2}{3}$ E. and E. $\frac{1}{4}$ N. The lower 43 feet, visible 12 miles seaward between the bearings E. $\frac{1}{2}$ N. and W. $\frac{1}{4}$ S.

A *fixed red* and *white* light is shown from an elevation of 26 feet, on Kruishoofd mole, 2,730 yards West of the last, the *red* light can be seen 4 miles, the *white* light 8 miles. It is *red* when bearing southward of S.W. by S. $\frac{1}{4}$ S. and *white* between the bearings of S.W. by S. $\frac{1}{4}$ S. and W. by S. The change from *red* to *white* indicates that the line of the Nieuwe Sluis lights must be departed from, and that Hompels bank has been doubled.

Fog signal.—A siren (near Nieuwe Sluis) westward of Breskens will give a short blast *every half-minute*. When the siren cannot be sounded, a steam whistle will give *three sounds every*

minute; the first a long sound, the second and third very short sounds.

At Breskens are two small *fixed white* lights on each end of the breakwater; a *green* light is also shown on the East harbour mole.

Beacon.—A short distance westward of Nieuwe Sluis, on the end of a mole bearing nearly North from Groede, stands a beacon 15 feet high, surmounted by a ball.

WALCHEREN ISLAND.—The northern coast of this island is composed of white sand-hills, and presents everywhere a clean landing beach; the western sand-hills are high in comparison with the others. Near this extremity of the island is Westkapelle, the tower of the old church being one of the most prominent objects on the coast, and generally to be seen from a distance well outside the sands at the entrance of the Schelde. To the westward of the church, and close to the shore, is a windmill.

Middelburg, the capital of the province of Zeeland, is near the middle of Walcheren; it has numerous spires and towers, and one of the former is very useful as a sea-mark, as in clear weather it can be seen from outside the banks. Middelburg is connected with Flushing by a ship canal of 158 feet least width, which will admit vessels drawing $23\frac{1}{4}$ feet to go up to Middelburg, and with Veere on the north-east side of Walcheren by a canal named Middelburg haven.

Dock.—Prince Hendrik dry dock is 480 feet long over all, 66 feet broad, and has a depth of 15 feet over the sill at high water.

Lifeboat.—Westkapelle is a lifeboat station.

SANDS.—The Fairy, Hinder, and Bligh banks, and Thornton ridge, shoals lying in the offing abreast the Schelde, and obstructing the approach to it, have been described at pages 37–41. There are also within or north-east of Thornton ridge, shoals of a similar character, such as the Raes, Middel, and Steen banks; but as these latter are opposite the Roompot to the northward of Walcheren, they will be noticed under the head of East Schelde, pages 110–114.

Het Zand.—On the southern side of Wielingen channel the 4-fathoms edge continues eastward of Wenduyne bank to a little eastward of Kadzand, where it is steep, having 5 fathoms close to it. The outer portion of the space thus bounded is known as Blankenberghe flats. Het Zand is a ridge inside Blankenberghe flats, and joining Wenduyne bank with Paardemarkt bank, having 17 feet

water upon it. Between this ridge and the shore the water deepens again and forms a gully in continuation to the westward of the Appelzak with from 21 to 24 feet water in it.

Paardemarkt bank is a shoal commencing at $1\frac{1}{4}$ miles North of Heyst and extending in an easterly direction, to abreast Kadzand. There are 15 feet water near its western end, but from the middle of the bank to its eastern extremity there is not more than from 2 to 7 feet.

Appelzak.—Between Paardemarkt bank and the shore is a gully named Appelzak, in which is Heyst and Knocke road, with from 4 to 5 fathoms water in it. Vessels can enter it from the west or east by keeping quite close to the shore.

Knocke, Heyst and Hompels banks form the northern boundary of Wielingen channel, and the southern boundary of the Spleet. The general direction of these shoals is from East to E.S.E., and their combined length 11 miles; they have a considerable curve to the northward, and average a quarter of a mile broad.

Knocke bank was formerly a continuous bank with the Hompels, but it has been divided by the tidal streams. The western bank, named Heyst has 13 feet water on it; the west end of the bank is 17 feet lies with Wielingen light-vessel bearing E.S.E., distant $1\frac{1}{2}$ miles. Both Knocke and Hompels sands are steep-to on their south side.

Buoys.—The outer buoy of the Wielingen channel, *black* and *red* horizontally striped and surmounted by a *black* ball, lies in $4\frac{3}{4}$ fathoms, half a mile N.E. by E. of Wandelaar light-vessel. See page 17 for future buoyage.

Black buoys, besides the outer buoy above-mentioned, mark the north side of Wielingen channel.

On the south side of the channel off the centre of the Paardemarkt, a *white* buoy is moored in 29 feet. To mark the south side of Fransche pass, a buoy with *red* and *white* horizontal bands and surmounted by a *red* ball is moored near the east end of Paardemarkt bank about abreast of Sluis gat; and a *white* beacon buoy is placed near the west end of Plaat van Breskens in 30 feet, at three-quarters of a mile E.N.E. from fort Frederik Hendrik.

Wandelaar bank, is at the entrance to Wielingen channel 4 or 5 miles northward of Wenduyne. The bank consists of small knolls, generally steep-to, with from 22 to 29 feet on them.

Light-vessel, see page 93.

Schooneveld, Raan, Walvisch staart, and Elleboog, at times called collectively the Raan, are four sands lying nearly in

the middle of the mouth of the Schelde. They curve in a direction nearly parallel to the Heyst, Knocke, and Hompels, and form between the latter and themselves the Spleet channel, which is unbuoyed, while together they constitute the south-west side of Deurloo channel.

Schooneveld bank lies on the south-western portion of the flat, and is so liable to change that it is not safe to cross it; a large portion of it carries 16 feet water, but the prevailing depth upon the remainder of the bank is 3 fathoms.

Raan flat, over which the depths are tolerably even, is about 3 miles wide N.N.E. and S.S.W. at its western end, the bank narrowing towards its eastern end, upon which the Walvisch staart and Elleboog banks are based, and the shallowest portion of it, the Raan proper or Ridge, abreast the Knocke, has as little as 8 feet upon it.

Walvisch staart, or Whale's tail, is abreast the Hompels. Portions of the staart dry at low water, on the remainder the depths range from one to 5 feet.

Elleboog, on the north-east side of the staart, may be considered as an extension of the Raan, it extends to abreast Flushing, and forms the western boundary of the Galgenput. The south-eastern or inner end of the Elleboog dries at low water and is steep-to.

Buoys.—The south-west side of the Deurloo channel is marked by *white* buoys, which lie on the north-east side of the Raan and Elleboog. The northern side of the channel is marked by *black* buoys, except the outer buoy, which is *red*. See page 17 for future buoyage.

The south-eastern edge of the Elleboog and of the Walvisch staart is marked by three *white* buoys.

Kaloo, Botkil, Rassen,* and Zoutelande banks, which collectively may be termed Rassen, make the next group of shoals, which, fronting the western coast of Walcheren in the form of an irregular triangle, separates Deurloo channel from East gat, and with the shore of Walcheren bounds the latter passage.

Kaloo and Botkil banks may be considered as the north-eastern portion of the Rassen, and the western boundary of the entrance to East gat; there is a patch of 12 feet upon them, but the prevailing depths are $2\frac{1}{2}$ and 3 fathoms. Kaloo bank

* The name Rassen is applied by the Dutch to several smaller shoals upon this coast, and seems to imply some rotary or irregular motion of the tides in the neighbourhood, probably equivalent to the English word Race.

is joined to the Botkil by a narrow neck, the outer or Kaloo bank buoy, a *red* nun, with staff and ball, lies in about $4\frac{1}{2}$ fathoms, one mile E. $\frac{1}{4}$ S. from its north-eastern end. This buoy breaks adrift occasionally in bad weather. *See* page 17.

Rassen bank is very shallow throughout ; a great portion of it has less than 6 feet upon it, and a part dries. This shoal forms the north-east boundary of Deurloo channel.

Zoutelande bank lying within the south-east part of the Rassen is narrow, and extends in a direction nearly parallel to the shore of Walcheren at less than half a mile, from abreast Zoutelande light-house to opposite the Kaapduinen. The depths over the greater portion of it are 2 and 3 feet, and a part of it dries. In continuation of Rassen bank, it forms the western side of East gat. The eastern or inner edge of Zoutelande bank which is steep-to, is marked by *white* buoys, and its south-east end has a *red* buoy upon it marking the point of junction of East gat and Deurloo channel, abreast of Kaapduinen lights.

Kueerens, or Domburger Rassen, bounds the entrance of East gat to the eastward ; but as this shoal will be described in connection with the Roompot (page 116), it is only necessary to remark here that Westkapelle lighthouse bearing South leads just to the westward of or outside it.

Le Nolle plaat extends $1\frac{1}{2}$ miles W.N.W. of Flushing, it is narrow and on many places has but 6 feet water on it, and is constantly changing. It is separated from the land by a very narrow passage named Schardingegeul, in which there are from 4 to 12 fathoms water in front of the Lenghenaar breakwater. There is no passage between the Nolle plaat and Elleboog bank.

The West haven bastion light at Flushing shows *red* over the Nolle plaat.

A *black* buoy is moored at its west end in 16 feet water, and *white* can buoys mark the north-east and east sides of Le Nolle plaat. *See* page 17 for future buoyage.

WIELINGEN CHANNEL, or Fransche pass, is an excellent channel, and by far the best passage into the Schelde. The channel begins abreast Blankenberghe, and trends E. by S. about 22 miles to Flushing. Its breadth is generally $1\frac{1}{4}$ miles. For navigable depths *see* page 90.

Light-vessel, *see* page 93.

Tidal streams in Wielingen channel.—Here the first of the flood and last of the ebb runs in a southerly direction, and is at times so strong, that ships entering close hauled on the port tack are obliged

to anchor on account of it, until the stream runs inward in the direction of the channel, which, as before stated, takes place much earlier than at sea.* See page 92.

It is high water at Flushing nearly an hour before the stream has done running up, so that it is more than one hour after high water at that place before the ebb begins regularly to run down to the different gats. It then runs in a W.N.W. direction to the Wielingen, uniting with the ebb which runs out from off Hoofdplaat in a north-west direction. When as far as Walvisch staart bank the ebb stream runs more seaward, from W.N.W. to N.W., over that bank, and the earlier in the tide the more northerly its direction; it is the same over the Hompels, Knocke, and Heyst banks, further down in the Wielingen.

With southerly winds this northerly set of the ebb must be attended to carefully, especially when sailing close hauled out of this channel. The northerly tendency of the tide continues until it is low water in the gat, when the stream runs fairly out of the Wielingen; but soon after turns inward toward the shore, as far as S.W., and runs still longer further to the westward; so that, westward of Sluissche gat it ebbs one hour, Heyst two hours, and off Blankenberghe three hours longer than at Flushing, thus affording outward-bound ships the advantage of always having favorable streams.

On comparing this longer running of the ebb off Blankenberghe than at Flushing, with the circumstance of high water occurring earlier at the former place than the latter, and, consequently, also low water, there seems to be a contradiction, which can only be explained by the rotary motion of the tides; thus, when it is low water at Flushing, or six hours after high water, the stream runs W.S.W.; at the seventh hour, S.W.; at the eighth, S.S.W.; and at the ninth South; when it may be considered that the tide is just beginning to run in, although the depth of water has been increasing for nearly three hours. The further inward the more the banks interfere with the rotation, and, therefore, the more directly the stream runs.

Directions through Wielingen channel.—When entering southward of Wandelaar light-vessel, bring Wielingen light-vessel to bear E. $\frac{1}{2}$ S., and steer that course until Bruges steeples are in line with Lisseweghe, when alter course to E. by S., keeping Nieuwe Sluis lighthouses in line, which will lead up to the light-vessel and through the channel to Fransche pass between Hompels and Kadzand island,

* See Tidal diagrams on Admiralty chart :—Entrance of the Schelde to Antwerp, No. 120.

in not less than $4\frac{3}{4}$ fathoms. This course leaves in succession all the *black* buoys upon the port hand, and the *white* buoy and the *white* and *red* striped buoy which mark Paardemarkt bank on the starboard hand. When the light on Kruyshoofd mole bears S.S.W. $\frac{3}{4}$ W. (or by night changes from *red* to *white*) steer more northerly, keeping the Orange mill well to the eastward of the harbour light at Flushing, with northerly winds, especially if they are light, this must be done as soon as possible, otherwise owing to the southern flow of the tide, it might not be practicable to reach the roadstead. From within the Hompels the course is E. by N. to the roadstead.

Should the buoys be removed (*see* page 17 for future buoyage), those running in with the marks just given may be certain of being abreast the eastern end of the Hompels, when Westkapelle, in Walcheren, is approaching the eastern base of Zaalduin, N. $\frac{1}{2}$ E.

Turning through.—For working up the Wielingen, no marks can be given, but the soundings are tolerably regular, and after passing No. 4 *black* buoy both sides may generally be approached to the depth of $5\frac{1}{2}$ fathoms; special caution, however, is necessary when standing towards the Knocke and Hompels, also the eastern part of Paardmarkt bank, for they are steep-to.

In Fransche pass, stand towards the Hompels till Orange mill and Flushing lighthouse are in line, E. $\frac{1}{2}$ N., or till between Nos. 7 and 8 buoys. When through, both sides may then be closed to the depth of $5\frac{1}{2}$ fathoms, until Middelburg spire is in line with the east bastion of Flushing N.E. $\frac{1}{2}$ N., which is the mark to run into Flushing road.

The nature of the bottom is a good guide, in the channel it is soft and near the sides it is hard.

Spleet channel is between Schooneveld bank and the ridge of the Raan and Walvisch staart, on the north side, and Heyst, Knocke, and the Hompels on the south side. The entrance abreast the west end of Heyst bank is about $1\frac{1}{2}$ miles wide. The south side is steep, but the north side may be approached to 3 fathoms until as far advanced as the Walvisch staart, where the sides are irregular and broken.

The Spleet channel is unbuoyed, and is seldom used by vessels. It may, however, with careful navigation and local knowledge be used by vessels drawing 16 feet.

DEURLOO CHANNEL is bounded by the Raan and Elleboog to the south-west, and by the Rassen and Zoutelande banks, and shore of Walcheren to the north-east.

Of the buoyed entrances to the Schelde the Deurloo may be considered the most difficult, partly from the great extent of the shallow banks on both sides, as well as from the great distance of the landmarks ; secondly, on account of the flat which lies across its mouth, named the Drempeel or bar, outside which vessels of large draught always wait till half-flood before they pass it ; and, thirdly, because the early tide running southerly, and not directly into the Deurloo till two hours before high water, it might set them on the Raan. For buoys, *see* page 98.

The Drempeel or bar, as well as the bottom in the middle of the channel, is hard ; but the margins of both the Raan and Rassen consist of soft clay. This bar or flat is of considerable breadth, and in June 1892 there were $14\frac{3}{4}$ feet on it.

Within the bar the depth is from $3\frac{1}{2}$ to $4\frac{1}{4}$ fathoms to abreast the inner end of the Rassen, and the breadth averages upwards of a mile ; $3\frac{1}{4}$ to 5 fathoms are the depths between the Elleboog and Zoutelande bank, increasing towards Flushing. In the Galgenput there are from 5 to $8\frac{1}{2}$ fathoms. All that part of the Elleboog which dries or nearly so is steep-to.

Tidal streams in Deurloo channel. — Outside Deurloo channel the rotary movement of the tides takes place as already described in page 92. When in a laden ship, and wanting to get into this channel with northerly winds, wait at least till nearly half-tide, or nine hours after the last high water at Flushing ; because the first of the flood runs strongly to the southward and it is only at two hours before high water at Flushing that the flowing tide runs straight into the Deurloo.

This difference in the direction of the stream is the reason why ships sailing with the ebb, under a press of sail from the Deurloo, can profit by that ebb no longer than four, or, at the utmost, five hours ; as the tide, continuing its rotary motion, will then again be running to the south-west, and setting direct upon the Raan.

The ebb runs from Flushing road to the Deurloo, N.W. and N.N.W., at first following the direction of the banks, to as far as between the Elleboog and Zoutelande bank ; but there, when the water has been falling two hours at Flushing, the ebb assumes a more northerly direction, as it does in the Wielingen, and sets over the bank of Zoutelande and the Rassen, till it is low water in the Deurloo ; when the tide begins to run nearly west, and so changes about to the south. But, contrary to what takes place in the Wielingen, where, the further to the westward, the longer the water

ebbs, here it will be low water at the outer buoy of the Deurloo one hour earlier than at Flushing.

Directions.—Directions for reaching the outer buoy of the Deurloo by the lead, when the land cannot be seen, would be given were it not that they would rather tend to confuse the seamen than to give him confidence. Without that thorough knowledge of the depths and nature of the soundings, which none but experienced pilots can possess, no person should make free with those banks, unless the marks on shore can be distinctly seen.

In many cases, whilst outside the Deurloo, Walcheren can be seen, but exceptionally clear weather is needful in order to make out the Belgian coast. A bearing of Westkapelle lighthouse E. by S. $\frac{1}{2}$ S. leads to the outer buoy.

If approaching from the south-westward, keep in 7 or 8 fathoms water upon the outer edge of the Raan, while nearing the outer buoy.

With Bruges steeples S. by W. $\frac{1}{2}$ W., and Oostkapelle and Domburg steeples in line E. by S. southerly, a vessel will be in a position $1\frac{1}{4}$ miles North, from the situation of the *red* or outer buoy; which, should it be necessary to wait for the flowing tide, is a good place to anchor. If hove to, for that purpose, keep Middelberg spire open to the southward of Westkapelle church, S.E. by E.

Caution.—Without special knowledge of the fairway it would, however, be unsafe to navigate Deurloo channel.

Turning through.—When working through the Deurloo, owing to the changes which take place in the banks, it is impossible to give clearing marks to those unacquainted with the channel. The north-east side of the Elleboog is steep; when standing towards it, tack when Westkapelle mill begins to appear over Walcheren duin. Great caution and constant use of the lead are necessary.

From the *red* buoy on the south-east point of Zoutelande bank, the Walcheren coast is clear, and may be approached by the lead up to Flushing, taking care to avoid the Nolle plaat described at page 99.

EAST GAT, which enters between Kaloo bank and Botkil bank on the west side, and Kueerens banks on the east side, is the easiest channel to sail in through, if necessary, without a pilot, especially with northerly winds.

The least depth of 23 feet (June 1892) is on the bar at the northern end of the gat.

The southern portion of East gat, which bears the name of Galgenput, lies between the coast of Walcheren and the east side of

the Elleboog. The Nolle plaat is really the southern bar (with $9\frac{1}{2}$ over it in June 1892) of the Galgenput or East gat. The marks may generally be seen distinctly; and the course is straight, until, rounding the point of Westkapelle, it changes from S. $\frac{1}{4}$ E. to S.E. by S. between Zoutelande bank and the shore of Walcheren.

Tidal streams in the East gat.—In the East gat, off Westkapelle, the tidal streams revolve in every respect the same as they have been stated to do at sea (*see* page 92); and above the mill of Westkapelle, the first of flood, and the flood in general, runs about south. The flood, or rather the entering of the water, on the north side of the Westkapelle dike, or near the Kaaphuisje, begins two hours before it is low water at Flushing; while on the opposite side of the gat, by the Rassen, the ebb stream, at low water, runs West and W.S.W. From Flushing road to near the corner of the dike, and on to Westkapelle mill, the ebb follows the direction of the coast, but always inclining towards the shore, as if pushed in by the Deurloo ebb, which sets over Zoutelande bank; the reverse prevails with the flood, which, from Westkapelle mill inwards, recedes from the strand, and runs southerly.

Respecting the general features of the Schelde tides, it is to be remarked that the ebb, which runs down the Schelde, and that which comes through the Sloe, and passes over the Kaloot bank, unite off Flushing. Below that town, where the shores diverge on either side in the shape of a funnel, the stream passes into various channels, which advance towards the different gats; while on the intermediate banks, the stream diminishes in strength in proportion to their lesser depth, and consequently accelerates in the channels.

Directions.—To enter East gat from the Steen deep, page 115, bring Middelburg spire in line with Domburg church S.S.E. $\frac{3}{4}$ E., and keep it so till East gat and Westkapelle lighthouses are in line bearing S. by E. $\frac{1}{4}$ E. If the weather be clear, keep on this course until Groede steeple is just open of Westkapelle point, bearing S. $\frac{1}{4}$ E., which will lead up to Westkapelle point, observing to open the mark in advancing in order to pass about 2 cables off the point. The course will now be about S.E. by S. on the line of the two light towers of Kaapduinen, until on that of the lighthouses of Westkapelle and Zoutelande on a N. by W. $\frac{1}{2}$ W. bearing, then steer on this line S. by E. $\frac{1}{2}$ E., with the lead going, until Kaapduinen lighthouses bear about N. $\frac{1}{2}$ E.

The best channel out of the Galgenput is between the shore of Vlissingen (Flushing) and the Nolle plaat by a narrow channel

named Schardingeguel, which is marked by four *white* buoys on the Nolle Plaat side, a *black* buoy on the south side of the bar. See page 17 for future buoyage.

Small vessels bound out, take advantage of the ebbstream at low water to cross the Botkil and get out to sea, especially with northerly winds.

At night.—Coming from seaward for the entrance of East gat, keep East gat light in line with Westkapelle light bearing S. by E. $\frac{1}{4}$ E., which will lead between the Steen banks in not less than 27 feet, to the entrance of East gat in 23 feet, and through the East gat whilst crossing the *red* sector of Domburg light; but on Domburg light changing to *white*, the course must be altered to S. $\frac{3}{4}$ W., passing the dike abreast of Westkapelle at a distance of 2 or 3 cables, until the leading lights of Kaapduinen are in line S.E. by S., keep them so until Zoutelande light is in line with Westkapelle light N. by W. $\frac{1}{2}$ W.; then steer with these lights in line astern; this course leads about 3 cables off the shore abreast Kaapduinen. When Flushing light bears S.E., a stranger had better anchor, the constant changes on the Nolle plaat (*see* page 99), rendering the services of a pilot necessary before proceeding any further.

FLUSHING ROAD lies between the town and the western point of Kaloot bank, and affords good anchorage in from 10 to 16 fathoms; gales from the westward send in a heavy sea, which compels ships to seek shelter higher up the river. The roadstead is the fairway formed by the union of the three sea channels known as De Honte.

Vessels of light draught may find good and safe riding in Rammekens road, 2 miles eastward of Flushing, between the north-west side of the Kaloot and the shore. To enter it, keep to the northward of the *red* buoy marking the spit of the sand, and anchor in 3 to 4 fathoms at a distance of about one cable from the shore. Large vessels must run up to the river, and seek shelter off Terneuse; there are no good marks, the buoys and the lead being the best guides.

By night, having passed to the northward of Spyker plaat steer about S.E. $\frac{1}{4}$ E. with Borsele light on the port bow, and keep to the southward of the *red* sector of the light until the two lights at Nieuwe Neuzen are in line bearing S. by E. $\frac{1}{2}$ E., keep on this course, and when Terneuse light changes from *white* to *red* at once alter course to about S.E. $\frac{1}{2}$ E. so as to bring the *white* light in sight again which will lead up to Terneuse.

Borsele point lights, $5\frac{3}{4}$ miles S.E. by E. from Flushing, is a *fixed* light elevated 18 feet above high water, showing *red*

from the bearing S.S.E. $\frac{1}{2}$ E. to S.E. $\frac{5}{8}$ E., over Kaloot bank; *white* from S.E. $\frac{5}{8}$ E. to E. by N. (indicating white can buoy No. 3a); *green* from E. by N. to N. by E. $\frac{3}{4}$ E. (indicating nun buoy No. 4); *white* from N. by E. $\frac{3}{4}$ E. to N.W.; and again *red* from N.W. to the shore. The *white* light should be visible in clear weather from a distance of 9 miles, the *red* light 4 miles, and the *green* about 3 miles.

The light support is an iron hexagonal framework, 16 feet high, with a circular reddish brown house.

At the distance of 240 yards N. $\frac{1}{2}$ W. from the above mentioned light, the high leading light is exhibited, showing a *fixed white* light, elevated 38 feet above the water, and visible in clear weather from a distance of 11 miles.

The light support is an iron hexagonal framework, 32 feet high, with a black house.

These two lights kept in line, bearing N. $\frac{1}{2}$ W., lead to the western entrance of Terneuse channel.

FLUSHING.—High sand-hills, which appear as distant hummocks from the offing, extend from Westkapelle to the strongly fortified town and arsenal of Flushing (Vlissingen), which, with the outwork at Breskens on the opposite side of the Schelde, completely commands the river. The spire of its church, the large square stadthouse, and the building sheds, and other works pertaining to a naval arsenal, taken in connexion with its advanced position upon the south point of Walcheren, render Flushing prominent from every part of the entrance to the Schelde. The Outer harbour, opened in 1873, is 33 acres in extent, and has a depth of $20\frac{2}{3}$ feet at low water springs. There are floating stages alongside the quays for the convenience of the mail and passenger steam-vessels which frequent the port.

The Outer (or Railway) harbour is separated from two inner harbours by a lock 486 feet long and $66\frac{3}{4}$ feet wide, with 27 feet water on the sill at high tide.

The Inner harbours have each a surface of about 16 acres, with a depth of 27 feet at high water, and warehouses, railways, and cranes round the quays. The depth is kept at 25 feet.

To the Eastern harbour there is a basin attached, in which ships of war are laid up in ordinary. These harbours are never closed by ice.

For canal harbour signals *see* page 95.

By means of the railway at Flushing, every part of Europe may be reached.

The Zealand line of packets run daily between Flushing and Queenborough in Medway river.

Pilots indispensable.—Above Flushing the bed of the Schelde is occupied by numerous sand-banks, which render the navigation intricate, and, to a stranger, the aid of a pilot is indispensable.

Dry docks.—There are two docks at Flushing ; No. 2, or the larger dock, is 377 feet long, 69 feet wide at the entrance, and has 29 feet over the sill at high water. *See Dock book.*

Repairs.—The Royal Ship-building and Engineering Company “De Schelde,” at Flushing, undertake building and repairing steam and sailing vessels, and have at their command the most modern appliances for casting, planing, turning, forging, &c. A vessel of 2,220 tons has been built. The Company possess a crane of 50 tons lifting capacity.

Time signal.—The signal is made from a stone tower on the western side of the lock of the Outer harbour. Four black discs are placed vertical at five minutes before, and fall into a horizontal position at noon Flushing mean time, or 23 h. 45 m. 36·8 s. Greenwich mean time.

Schelde up-river lights are subject to frequent changes in consequence of the alterations of the channels between Flushing and Antwerp ; a description of them will be found in the Admiralty list of lights, Part II., published annually.

Nieuwepolder light is exhibited from a house just eastward of Keel, on the north-west point of Nieuwepolder (Nieuwe-neuzenpolder).

The light is a *fixed white* light, visible from S. $\frac{3}{4}$ E. to S.W. $\frac{1}{2}$ S.

Terneuse lights.—At Nieuwe Neuzen are two *fixed white* lights on the bank of the outer dyke, bearing from each other N.W. by N. and S.E. by S. distant 459 yards ; the north light is elevated 18 feet and the south light 32 feet above high water, and should be seen respectively 9 and 10 miles.

At Terneuse west jetty, at the height of 43 feet above high water, is a *fixed* light, showing *red* when bearing eastward of S.E. by E. $\frac{1}{4}$ E., and *white* southward of that bearing. The *white* light should be seen 12 miles, and the *red* 6 miles.

On the Harbour mole heads two *fixed white* lights are exhibited, visible 9 miles. When the harbour is impracticable a *red* light is shown under the *white* light.

TERNEUSE is connected with Ghent by a canal with entrance gates 39 feet wide, for vessels drawing 18 feet to pass through and

unload in the basin of that city. Steam-vessels drawing 18 feet water, can coal at any time alongside the canal wharf. There is a railway to Hulst.

Ghent, with a population of 160,000, situated at the junction of the Schelde and Lys rivers, is reached by the canal from Terneuse, above-mentioned, also from Ostend: vessels of 2,000 tons can be accommodated in the port. In 1890, the vessels entered numbered 952 of the aggregate 427,351 tons, and there are regular steamers to the east coast of England ports, also to Bristol and Glasgow. A dry dock 426 feet long by 42 feet wide is in course of construction. *See Dock book.*

The outer harbour is 3,607 feet long, 295 feet wide, with a depth of 21 feet.

It is proposed to make a new lock at Terneuse and to dredge the canal, to admit vessels of any length and draught to 26 feet, or 16 feet at low water.

From Flushing to Antwerp, a detailed description of the river is not given, as in consequence of the frequent changes in the channels and shifting of the buoys, the services of a pilot are indispensable to strangers.

ANTWERP, the chief port of Belgium, is upon the right bank of the Schelde, 12 miles above its estuary, and 50 miles from the sea. The city is fortified on the land side, and its citadel to the south built by the Duke of Alva in 1567, is considered one of the most complete works of that character. The numerous public buildings of Antwerp, chief among which is its celebrated cathedral, give a highly picturesque appearance to the city. The quay along the Schelde is spacious, and there are several commodious wet docks or "Bassins," for the dimensions of which, *see Dock book.*

Time signal.—At the Hanseatic House, the signal, consisting of four discs on a mast, is made daily. The discs are placed perpendicularly at five minutes before the signal, and fall into a horizontal position at 1h. 0m. 0s. p.m. Greenwich mean time.

This time-signal station is in telegraphic communication with the Royal Observatory at Brussels, and can be seen from all vessels lying in the harbour and road of Antwerp. If from any cause the signal will not be given a blue flag is hoisted.

Trade.—The trade of Antwerp is extensive; and consists chiefly of hides, coffee, sugar, cotton stuffs, metals, tobacco, wood, rice, petroleum, wool, provisions, and other manufactures, a large proportion of the latter being forwarded to various parts by means of canals and

railways. In 1891, 4,461 vessels with a tonnage of 4,693,238 tons entered at Antwerp. The passenger traffic is also very considerable ; it is carried on by steam-vessels to all the chief ports of the Home trade, of which several ply between Antwerp and Hull and London. There are direct lines to the river Plate, Brazil, New York, West Indies, Australia, India, China, Mediterranean, Black sea, Sweden, San Francisco, the ports of the Low countries and other places. Railways connect Antwerp with all parts of the Continent, and the telegraph with all parts of the world where wires are laid.

Antwerp has, moreover, become an important point of embarkation for emigrants. The Antwerp fever, a sort of ague and fever, is sometimes taken by new comers residing in the damper and lower parts of the city. There are two public hospitals at which sailors can be received when ill. The population in 1891, including the immediate suburbs, was 302,816.

Coaling.—Vessels can lie alongside the quay, and the coals are brought either in lighters or by railway trucks. At low-water there is a mean depth of 27 feet.

Repairs and supplies.—Every description of repairs to steam or sailing vessels by skilled workmen can be effected. Stores of all kinds may be obtained.

Docks.—Floating dock : length 460 feet, width of entrance 82 feet, depth on sill 21 feet, and at times 23 feet. The largest vessel yet docked was 447 feet long ; 5,994 tons gross or 4,320 tons net. There are several graving docks, for the dimensions of which, *see* Dock book.

CHAPTER IV.

THE SCHELDE TO GOEREE.

VARIATION 15° West in 1892.
(Decreasing $8'$ annually.)

The **EAST SCHELDE**, after separating from the West Schelde, at the head of the estuary, passes along the north-east side of South and North Beveland islands, and joins the sea from between Walcheren and Schouwen islands by an outlet encumbered by dangerous and extensive sands, through which there are two channels, the main one being named the Roompot.*

The entrance to the East Schelde has little to distinguish it except the lighthouses on either side. From Westkapelle, the north-west side of Walcheren, trending north-easterly, is skirted by moderately high sand-hills, upon which are several signal stations, while a short distance behind, appear the churches of Domburg and Oostkapelle. The former has a small tower surmounted by a spire; the latter has a broader tower and a shorter spire. Eight miles eastward of Westkapelle, at Veere gat, the shore of Walcheren trends southerly to Veere, the church of which place is distinguished by a dome. From every direction at a short distance off Walcheren island the noble spire of Middelburg shows well above all the other objects, and consequently forms an excellent sea-mark. The shore of North Beveland, trending E.S.E. from Veere gat, is low, with some wood here and there.

Schouwen island, on the opposite side of the East Schelde, has at its north-west end many sand-hills, some of which, named the Woolpacks, are long and white; the others appear as green hummocks. Among them stands the prominent object, Schouwen lighthouse, described at page 121, and in clear weather, the massive

* See Admiralty charts:—River Schelde from the sea to Antwerp, No. 120; and Mouths of the Maas, No. 122; scales, $m = 1.0$ inch.

tower of Zierikzee church, at the south end of the island, may, from its superior magnitude, be seen at a considerable distance.

Zierikzee, noted for its oysters, of which large quantities are exported, is connected with the East Schelde by a canal $1\frac{1}{2}$ miles long and running straight in a W.S.W. direction. The town has a small shipping trade, but the chief employment of the place is the production of madder. (*See* page 118.)

LIGHTS.—On Oosterhoofd sand hill, north side of Walcheren island, a *fixed red* light is exhibited at an elevation of 39 feet above high water, and should be visible from seaward and over Roompot in clear weather through an arc of 180° , between the bearings E.N.E. and W.S.W., from a distance of 5 miles.

Veere.—At Kampveer tower, is a *fixed* light visible between N.W. $\frac{1}{2}$ N. and S. $\frac{1}{2}$ E., it shows *red* from S.E. by E. $\frac{1}{2}$ E. to S.S.E. $\frac{1}{4}$ E., and is obscured between S. $\frac{1}{2}$ E. and S.S.E. $\frac{1}{4}$ E. It is elevated 38 feet and is visible 10 miles.

There are two *fixed green* lights at Veere, one on the north mole head at 35 feet above the sea, and one on the south mole head 23 feet above the sea.

At Wulpenburg a *fixed white* light is shown, at 33 feet above high water, and visible 8 miles eastward, from S. by E. to N.N.W., or from the Sloe channel to Veere gat; a *red* sector is shown in the direction of Goudplaat.

Zierikzee is a *fixed white* light, 43 feet above high water, and visible at 8 miles; it is shown from a house upon the west pier of the harbour, which is seen in the road and channel to it.

Val.—Val light, *fixed*, shows *red* from E.S.E., through east, to N.E. $\frac{3}{4}$ N.; *white* from N.E. $\frac{3}{4}$ N. to North; *green* from North to N. by W. $\frac{1}{4}$ W.; and again *white* from N. by W. $\frac{1}{4}$ W. to W.N.W.

The *white* light is visible 11 miles, the *red* light 4 miles.

RABS SHOAL.—Several sands, lying in a direction parallel to the shore, and fronting the entrance to the East Schelde and Brouwershaven gat, extend north-eastward from near Thornton ridge. The first in continuation from the latter shoal is the Rabs, or Wascels Rabs, a broad cluster of sandy knolls, which lie equally in the way of vessels bound to the West Schelde through Deurloo channel and East gat, or to the East Schelde. The line of 10 fathoms around the Rabs embraces a space 8 miles long in a N.E. by E., and S.W. by W. direction and $2\frac{1}{2}$ miles broad; the shallowest water being near the centre, where, over a square mile, the depth is from a little less to a little more than 4 fathoms.

By day, the centre of the shoal is marked by Middelburg spire and Westkapelle light-tower being in line S.E. by E., distant 13 miles from the latter ; and, if very clear, Bruges steeples will be seen just to the eastward of Lisseweghe steeple, S. $\frac{3}{4}$ W. From near the centre of the Rabs the light-buoy on the north-east extreme of Thornton ridge bears W. $\frac{1}{4}$ N., distant $4\frac{1}{2}$ miles.

Westkapelle S.E. $\frac{1}{4}$ E., leads in 6 fathoms across the north-east end of the Rabs ; Middelburg spire, open a distance equal to thrice its apparent height south-east of Westkapelle and bearing S.E. by E. $\frac{1}{4}$ E., just clears the shoal on the south side.

At night, Westkapelle light S.E. by E. $\frac{1}{2}$ E., leads between Thornton ridge and the Rabs, in 8 fathoms.*

The Schar, 2 miles outside the north-east end of the Rabs, is a narrow ridge 5 miles long in an E. by N. and W. by S. direction, with 7 to 9 fathoms upon it. There are several ridges of a similar character further out, between the Schar and the Hinder banks.

SCHOUWEN BANK is nearly in continuation of the Schar to the north-eastward, and is opposite to Brouwershaven gat rather than the East Schelde. There are several small ridges nearly in connexion with this bank ; but the latter, taken within the 10-fathoms line, is a ridge 13 miles long in an E.N.E. and W.S.W. direction, and one mile broad. The narrow shoal, known as East Schouwen bank, with $3\frac{3}{4}$ to 5 fathoms, extends 4 miles N.E. by E. and S.W. by W. ; the eastern end lies N.E. by N. distant 2 miles ; and the western end West, distant $2\frac{1}{2}$ miles from the position of the light-vessel. The shoal ridge is so narrow, that unless the lead is hove rapidly it may be passed over unnoticed.

From the north-east end of this shoal the lighthouse on Schouwen island, north-west extreme, bears about S.E. $\frac{1}{2}$ S. distant 16 miles. The prevailing depths over the other parts are 6 and 7 fathoms. There are 13 fathoms close to Schouwen bank on both sides.

A series of ridges, with 8 to 6 fathoms upon them, extend north-eastward of Schouwen bank to abreast Brielle gat. One patch (the shallowest) of 5 fathoms, lies 4 miles E. by S. from the east end of the shoal portion of Schouwen bank.

Middelburg spire in line with Domburg church, S.S.E. $\frac{3}{4}$ E. leads between the Schar and Schouwen bank, across the deep water on the Middel bank, and through the swatchway of the Steen banks to a fairway for either the East gat or the Roompot.

* See Admiralty chart :—North sea, No. 1,406 ; scale, $m = 0.3$ of an inch.

Schouwen bank light-vessel.—The light is a *triple flashing* light, showing *three white flashes* in quick succession *every half minute*, elevated 36 feet above the sea, and should be visible in clear weather from a distance of 11 miles. A riding light is also shown.

The light-vessel, painted *red* with broad *white streak*, and having the name *Schouwen bank* on sides, is moored in 13 fathoms, on the inshore edge of bank. The light is on the mainmast; by day a *black* ball is carried at the mast head; the vessel also has a jigger mast. From the light-vessel, Schouwen lighthouse bears S.E. $\frac{3}{4}$ E. distant $10\frac{1}{2}$ miles.

Two *watch* buoys, painted *red* with *white* band, and the letters S. B. No. 1 and 2 on them respectively, are moored on the eastern edge of the bank.

NOTE.—When from any cause the *flashing* light cannot be exhibited, a *fixed white* lantern light will be shown from the mast head, and a *white* flare every ten minutes from above the gunwale. When the light-vessel is not in station, the usual lights will not be exhibited, but a *fixed red* light will be shown at each end of the vessel. By day a *red* flag will be hoisted above the *black* ball at the mast head.

Should a vessel be seen standing into danger, a gun will be fired, and repeated if necessary; also, the signal flags J. D. of the International Code "*You are in danger*" will be hoisted and kept flying until answered.

A bright rocket immediately after a gun denotes that those on board require assistance from the shore.

Fog signal.—A siren gives *three blasts* in quick succession *every two minutes*. If the siren is out of order, a bell is sounded *three times* in quick succession *every half minute*.

Tidal streams.—The direction and rate of the tidal streams at Schouwen bank light-vessel are as follows :—

TIDES AT DOVER.				TIDES AT SCHOUWEN BANK LIGHT-VESSEL.			
5 hrs. before high water	...	{	Slack turning from North to West.	}	0 to $\frac{1}{4}$ knots.		
4 " " "	...	...	W. by S. $\frac{1}{2}$ S.	...	$\frac{1}{2}$ " 1 "		
3 " " "	...	...	S.W. by W. $\frac{1}{2}$ W.	...	$\frac{3}{4}$ " $1\frac{1}{4}$ "		
2 " " "	...	...	S.W. by W.	...	1 " 2 "		
1 " " "	...	...	S.W.	...	1 " 2 "		
High water	...	...	S.S.W.	...	$\frac{1}{4}$ " $\frac{3}{4}$ "		
80.11363				H			

TIDES AT DOVER.

				TIDES AT SCHOUWEN	
				BANK LIGHT-VESSEL.	
1 hr. after high water	...	{ Slack turning from South to East }		{ 0 to $\frac{1}{2}$ knots.	
2 " " "	...	...	... E.N.E.	... 1	" 2 "
3 " " "	...	...	N.E. by E.	... $1\frac{1}{2}$	" $2\frac{1}{2}$ "
4 " " "	...	...	N.E. $\frac{1}{2}$ E.	... $1\frac{1}{2}$	" $2\frac{1}{4}$ "
5 " " "	...	...	N.E. $\frac{1}{2}$ N.	... 1	" $1\frac{1}{2}$ "
6 " " "	...	...	N. by E.	... $\frac{1}{4}$	" $\frac{3}{4}$ "

Middel bank, $1\frac{1}{2}$ miles within Schouwen bank, is in continuation of the Rabs to the north-eastward, and lies across the entrance of the East Schelde, as it extends north-eastward to nearly abreast Brouwershaven gat. This shoal lies E.N.E. and W.S.W., is 14 miles long, and one mile broad, except at its west extreme, which is irregular in breadth and depth. The shallowest part is at the ends. At the western end there are several patches of 4 fathoms, and at the eastern end is one patch of $3\frac{1}{2}$ fathoms; but over a space nearly 8 miles long between these shoal parts there are 6 and 7 fathoms.

STEEN BANKS, 2 miles within Middel bank, and the last of the off-shore shoals now under notice, are, to the westward a distinct ridge, covering Steen deep, or Walcheren road, but their east end is connected with the flat from the main. Steen banks are divided by a swatchway, and fronts the approach to the Roompot. From the depth of 5 fathoms upon the west end of the banks, Westkapelle tower bears S.E. $\frac{3}{4}$ S. distant $8\frac{1}{2}$ miles; from which point their general direction to the like depth at the east end is E. by N. $\frac{1}{2}$ N. for $7\frac{1}{2}$ miles.

Noord Steen bank is the shallower, there being 2 fathoms in some places upon the ridges, which are narrow.

Zuid Steen bank has $2\frac{1}{2}$ fathoms water on its shoalest part, $7\frac{1}{2}$ miles from Walcheren island. The swatchway is one mile wide with from 5 to 8 fathoms in it; the mark through which, previously mentioned, is Middelburg spire and Domburg church in line S.S.E. $\frac{3}{4}$ E. In calm weather the water ripples over the Steen banks, but in stormy weather it breaks heavily.

Middelburg and Oostkapelle churches in line S. by E. $\frac{1}{4}$ E. leads north-eastward of the shallowest parts of the banks.

Buoys.—A *black* and *white* buoy in horizontal stripes, with a *white* ball and staff, is moored at the south-west end of the Steen in 7 fathoms. See page 17, for future buoyage.

A *red* and *white* chequered buoy with a *red* staff and triangle, lies in 6 fathoms off the south-west end of Noord Steen bank.

STEEN DEEP, or Walcheren road, as it is at times called, is about 2 miles wide, and 8 miles long, in an E. by N. $\frac{1}{2}$ N. direction, with 12 to 7 fathoms in it, and has a clay bottom, in which anchors hold well.

Directions.—To enter Steen deep, the passage either south-west or north-east of the Steen banks, or the swatchway between them, may be taken.

When proceeding through the swatchway, with Middleburg spire and Domburg church in line, S.S.E. $\frac{3}{4}$ E., observe, that while the angle between Westkapelle and Domburg steeples is less than $18^{\circ} 12'$, the vessel will be to the north-westward, or outside the swatchway; when the angle between the same objects is $20^{\circ} 15'$, in it, in from 5 to 6 fathoms; and when the angle is further increased to $22^{\circ} 27'$, within the banks. The best anchorage is with Middelburg spire in line with the west end of the wood between Oostkapelle and Domburg, S. by E. $\frac{1}{2}$ E. easterly, and Westkapelle church S. by W. $\frac{1}{4}$ W. westerly; the depth 7 and 8 fathoms. Here, should the wind come to blow hard on shore, some shelter might be afforded by Noord Steen bank, or, if obliged to put to sea, an outlet would be found at either end of the banks, or through the swatchway; the Roompot would also be open.

Tides in the East Schelde.—Off the gats of the East Schelde the tidal streams have the same rotary motion as those off the gats or channels of the West Schelde, as noticed in pages 91–93.

In the Roompot the flood runs at the commencement towards the shore, the same as in the Wielingen, but inside Oostkapelle its direction follows the coast.

In the Roompot, the flood and ebb run in and out about two hours longer than in Veere gat, on the other side of the Onrust, making the latter part of the ebb of the Roompot the first of the flood in Veere gat.

In Veere gat the tides run fairly in and out, being hemmed in by flats, and the ebb, uniting at the Onrust with that of the East Schelde, runs along by Oostkapelle and Domburg, where it is again joined by the stream through East gat, and the united streams proceed about N.N.W. to the sea. In the same manner the flood stream divides at this spot, running partly into the Roompot and partly into East gat. This divergence and collision of the flood and ebb produce those eddies which have formed the irregular ground of the Kueerens.

Within the point of the Noordland, at the inner extreme of the South Banjaard, the first flood takes its direction over the Neeltje Jans ; and in like manner the first ebb draws northerly over the banks, on which account, both in going in and coming out, it is necessary to be guarded against this influence in light winds and calms.

It is high water, full and change, at Veere gat at 1h. 0m. ; springs rise 15 feet, and neaps 11 feet ; and at Zierikzee at 2h. 0m. ; springs rise $10\frac{1}{2}$ feet, and neaps 9 feet, but the strength and direction of the wind will make a great difference in this respect.

The ROOMPOT, the principal entrance into the East Schelde, is formed between the Kueerens shoals and the shore of Walcheren to the south-westward, and the South Banjaard to the north-eastward. At first the direction of the channel is S.E. and its breadth is contracted to less than a mile by the Rassen ; here its depth is from 5 to 6 fathoms. Within the Rassen, from No. 2 buoy, the direction of the channel changes from S.E. to E. $\frac{1}{2}$ S., and the depth increases to 12 and 16 fathoms.

Kueerens, or Domburger Rassen, extends from the shore of Walcheren directly abreast Domburg, forming the eastern boundary of East gat (page 103), and the western boundary of the Roompot. From the depth of 17 feet upon the outer part of this shoal, Domburg church bears S.E. by S. distant $3\frac{1}{2}$ miles, from which point, its western side trends towards Westkapelle tower, and the eastern side about S.E. The Kueerens is irregular in depth, 14 to 18 feet being the prevailing depth ; there is generally a short breaking sea upon it, which renders it dangerous for a small vessel to approach. From near the inner part of it, a ridge, one mile off shore at Domburg, extends in an easterly direction and gradually shoaling, joins the shore abreast Oostkapelle. The appearance of the shallow water upon this ridge will generally serve to distinguish it from the deeper water within.

The Kaloo outer buoy, a *red* beacon buoy, lies in the entrance of the East gat, in $4\frac{1}{2}$ fathoms at half a mile from the depth of 15 feet on the north-west side of the Kueerens. See page 17, for future buoyage.

A *white* buoy surmounted by a *red* cross and staff, is placed in $4\frac{1}{4}$ fathoms, N.E. of the outer part of the Kueerens.

South Banjaard bank.—The North and South Banjaard are extensive flats, which bound the entrances of the East Schelde.

The south-west side of the South Banjaard forms the north-east side of the entrance into the Roompot. A considerable space on this bank named the Noordland, dries.

The southern portion of this bank is named the Hompels, upon which there are places with only 3 to 6 feet at low water, a deep channel intervening; and off the west side is the Rassen, a flat of irregular depths with a patch of 19 feet on it, forming the northern boundary of the Roompot.

North Banjaard bank, extending $7\frac{1}{2}$ miles in a westerly direction from Schouwen island, is separated from the South Banjaard by Middle or West gat, and its north edge is the south side of the entrance into Brouwershaven. This extensive sand is steep-to on the outer side, and is shallow throughout; on the north side there are two patches, the Nieuwe zand and Wynbol, and a considerable portion at its south-east end, named Zeehonden plaat, dries at low water. The western corner of the North Banjaard is called De Bol, and has only 5 or 6 feet water in some places. There are several swathways through the North Banjaard, but they are of little use, except to the small coasters and fishermen.

West gat, between the Banjaard banks, though deep, is narrow, constantly varying, and unbuoyed, and it is, therefore, but little used.

Buoys.—The following buoys mark the sea face of the Banjaard banks. See also page 17, for future buoyage.

The East (Oost) buoy lies in the channel on the north-west side of De Bol, nearly three-quarters of a mile south-east of the east end of Noord Steen banks, it is *white* with a perch and *black* half ball.

Banjaard West buoy, a large *white* nun with *red* ball, lies off the north-west end of the North Banjaard in 8 fathoms.

Black buoys mark the south-west side of the South Banjaard and the south side of the Hompels, or the north side of the Roompot. The Outer buoy, with a basket cone, lies in 5 fathoms at the south-west end of the Banjaard Rassen. *White* buoys mark the south side of the Roompot.

Bree zand is a portion of the strand of Walcheren on the west side of the entrance to Veere gat, its north-east spit is marked by *white* buoys. See page 17, for future buoyage.

The Onrust is a flat extending from the north-west point of North Beveland, and bounding the east side of the entrance to Veere gat, and the south side of the Roompot. Its north-west spit, at the entrance of the gat, is marked by a red buoy lying half a mile from the shore of Walcheren. The north side is very steep, except at its north-east angle, named the Schaar of Onrust, which is marked by a

white buoy (No. 2) with a basket cone, lying in 5 fathoms a long mile from the north-west part of North Beveland.*

Zierikzee road, between the shore of Schouwen to the north-eastward, and the spits of the Vuilbaard, Galge plaat, Vondelingen plaat, and Dortsman to the southward, has its latter boundary indicated by *red* buoys lying upon the spits of the last-mentioned three sands. Near the shore the depths vary between 9 and 20 fathoms; the anchorage is, therefore, over towards the south side in 10 fathoms.*

From near Zierikzee harbour the main channel of the East Schelde trends through Engelsche Vaarwater to the southward, and is bounded on the west by Vuilbaard bank, and by North Beveland. It then follows the shore of South Beveland, in a south-easterly direction. On the east and north-east sides lies various banks which contract its breadth in some parts to half a mile, but the water is deep, varying from 7 to 16 fathoms.

The channel of the East Schelde has now been traced as far as is necessary for the general use of seamen.

Directions for the East Schelde through the Roompot.—

The approach to the Roompot is from Steen deep, the directions for which have been given in page 115.

Veere church open westward of Oosterhoofd lighthouse, S.E. leads up the entrance between the Banjaard and Kueerens banks, on the, former of which the ground is hard compact sand, that of the channel being soft.

The leading mark also into the Roompot, from the anchorage in Steen deep, to that above mentioned, is Middelburg spire in line with the wood showing over the duins between Domburg and Oostkapelle, S. by E. $\frac{3}{4}$ E. easterly. This wood is not readily distinguished, as it is but little above the levels on either side of it, but Middelburg spire kept about one-third the distance from Oostkapelle church to Domburg church will lead to it between the outer *black* and *white* buoys. When within the outer buoy of the gat, an E.S.E. course made good for $3\frac{1}{2}$ miles will lead to the entrance of Veere gat. Attention must be given to the lead and the buoys.*

Up the East Schelde.—The channel of the East Schelde, by Zierikzee, in continuation of the Roompot, is marked by the *black* buoys on the port hand, and by the *white* buoys on the starboard hand. The average breadth of the channel is upwards of half a mile, and the depths vary between 6 and 16 fathoms.*

A detailed description is not given, in consequence of the frequent changes in the sands and buoyage.

* See page 17, for future buoyage.

Vessels may anchor one-third or half a mile off the shore of North Beveland from Oudelek as far as Kolynsplaar, or to within the Vuilbaard in from 10 to 14 fathoms.

From near Zierikzee, the main channel of the East Schelde continues in a S. $\frac{1}{2}$ W. direction between the Vuilbaard and Galge plaat, and between the latter and the shore of North Beveland as far as the second *black* buoy of Galge plaat to the north of Zand kreek which separates North from South Beveland, and afterwards S.S.E. and S.E. by E. between the Vondelingen and Middel plaats and South Beveland. Of this portion of the channel it will be only necessary to say that as far as Gorishoek it is broad and safe, with regular soundings and deep water, there being seldom less than 6 fathoms, so that large ships may run in from sea and up the river to that point of Tholen island, but from whence to Bergen-op-Zoom the channel is narrow and intricate, and no stranger should take it without a pilot.

Through the West gat.—Although the West gat between the Banjaard banks is constantly changing and unbuoyed, it is at times a convenient passage to vessels approaching from sea, north of the Steen banks, and bound to Zierikzee, attention to the lead and a good look out being very necessary.

Lifeboat.—There is a lifeboat station at Burgsluis.

MAAS RIVER or Meuse flows through part of Belgium and Holland, and is joined by branches of the Rhine. It empties into the North sea by three mouths, between Schouwen, Goeree, Voorne, and the Hook of Holland. These all communicate with one another by minor channels or canals, and have upon their banks the towns Brouwershaven, Hellevoetsluis, Willemstadt, Rotterdam, &c.*

Pilots.—The Brouwershaven pilots cruise off Dungeness in cutter-rigged vessels; and off the gat, within range of Schouwen light, in round-sterned vessels, with two masts. They have the names *Goeree*, *Maas*, and *Brouwershaven*, painted in large letters on the main-sail. While in company with other pilot-vessels, they show a blue flag with their number, and also the Dutch flag from the gaff end. In the event of a pilot-vessel not being fallen in with, the lifeboats belonging to the Zuid Hollandsche Redding Maatchappy are generally on the look out to supply qualified persons, or to render assistance. The lifeboats have discontinued carrying a flag or a name in their main-sail, to avoid being mistaken for pilot-vessels.

*See Admiralty chart;—Mouths of the Maas, No. 122; scale, *m* = 1.0 inch.

BROUWERSHAVEN GAT.—The town of Brouwershaven, at the eastern part of the north side of Schouwen, gives its name to the gateway or main navigable channel between the islands Schouwen and Goeree, the southernmost of three passages into Maas river.

The town is ancient, and its fortifications have been removed. The population, numbering about 1,100 persons, are nearly all agricultural; the herring fishing, which was formerly prosecuted from here, being now all but extinct. A British vice-consul is resident.

The harbour is dry at low water, and only fit for small vessels.

Brouwershaven road is frequented by vessels bound to Dordrecht and Hellevoetsluis; here they discharge a portion of their cargoes, and are then towed to their place of destination. The road has the advantage of excellent holding ground, and being well protected by shoals, is seldom troubled with sea.

The general appearance of the seaward part of Schouwen island, its white sand-hills, the Woolpacks at the west end, and the prominent character of Zierikzee church, have been already noticed in page 110.

Goeree island on the opposite side, and 11 miles from the entrance to the gat, when viewed from a distance appears as detached white hummocks, those at the western end being the highest. It is necessary to remark, that the absence of a light-tower at its outer or western end should prevent its being mistaken for Schouwen, page 110.

Brouwershaven gat has on its south side, the North Banjaard and the shore of Schouwen, and on the north side the Ooster zand; its entrance is about three-quarters of a mile wide, from a low-water depth of 4 fathoms on each side, to abreast the west end of Schouwen.

Navigable depths to Brouwershaven road.—A vessel of 29½ feet draught can navigate the channel from sea to Brouwershaven road at high water neaps, and of 22½ feet draught at low water springs. The heaviest draught vessel that has visited the port was of 26 feet draught.

DORDRECHT, on the Oude Maas, 14 miles above Willemstadt, has a population of 30,000. The town has a considerable amount of trade, 300 vessels with an aggregate tonnage of 88,000 tons, and 4,000 river vessels of 370,000 tons annually enter the port. A vessel drawing 20 feet has entered Dordrecht harbour.

There is a slip for hauling vessels up on, and repairs to hull or machinery can be made.

Coal.—There is always about 300 tons of steam coal in store, and vessels can coal alongside the quay, which has 16 or 17 feet water at low tide.

Lifeboats.—There is a lifeboat stationed at Brouwershaven.

LIGHTS.—The chief objects which serve to distinguish Schouwen from the islands near it, are the several lighthouses standing on the northern parts of the island, for the purpose of distinguishing the coast, and for leading marks through Brouwershaven gat.

Schouwen lighthouse, the principal of these, is a circular stone tower with black gallery, standing on one of the sand-hills at the north-west extremity of the island near the Hook of Schouwen. It exhibits at 171 feet above high-water, a *white double flashing half minute* light, showing *two flashes* of *four seconds* duration each, divided by an eclipse of *three seconds* duration; the second flash being followed by an eclipse of *nineteen seconds*.

The light is seen from a distance of 20 miles in clear weather.

A light (Virklikker) for showing the anchorage and assisting in the navigation of Brouwershaven gat, is exhibited from a dwelling with a blue roof upon the shore of the north-west part of the island, one mile N.E. from Schouwen lighthouse; it is a *fixed white* light, elevated 55 feet above high water, and visible at 6 miles.

Haamstede light is a *fixed white* light, exhibited from a yellow shed, and is visible 6 miles.

Renesse.—The two light-towers at Renesse, at the north side of the island, half a mile from the village of that name, bear E. by S. $\frac{3}{4}$ S. and W. by N. $\frac{3}{4}$ N. from each other, distant 850 yards apart.

Both lights are *fixed white*, the eastern 152 feet and the western 111 feet above high water, and are visible respectively 18 and 16 miles. To prevent their being mistaken for other lights, they are screened so that the western light can be seen only between the directions of E. $\frac{1}{2}$ S. and S.E. $\frac{1}{2}$ S., and the eastern light between the bearings of E. $\frac{1}{2}$ S. and S.E. $\frac{3}{8}$ S., or for 3 or 4 miles on either side of the approach to Brouwershaven gat, for which when in line they are the leading lights.

The eastern light also shows a *red* sector between S.E. $\frac{1}{2}$ E. and S.E. $\frac{1}{2}$ S.; and a *white* light between S.W. by W. and N.W. by W., and is obscured between S.E. $\frac{1}{2}$ S. and S.W. by W. over Middel plaat.

Ossenhoek.—The *fixed white* light shown from Ossenhoek on the end of Lange dike, near Brouwershaven, is intended to assist the pilots in navigating the inner part of the channel ; it is elevated 25 feet, on a wooden structure, and is visible 9 miles, between E.S.E., through south, to N.N.W.

Buoys.—Besides the buoys westward of the Banjaard, page 117, the south side of the gat is marked by *white* buoys, placed near the edge of the banks. The northern side of the gat is marked by *black* buoys. A beacon with a triangle is placed at Ossenhoek, at the entrance of the port of Brouwershaven. See page 17 for future buoyage.

Tidal streams in Brouwershaven gat.—It is high water full and change, in the offing at Noon ; at the outer buoy of the gat at 1h. ; and at Brouwershaven at 2h. 0m. At the gat, springs rise $9\frac{1}{4}$ feet, and neaps $7\frac{1}{2}$ feet ; but the strength and direction of the wind will make a great difference in this respect.

Outside Brouwershaven gat the streams of tide have the same rotary motion as those of the gats or channels of the West Schelde, as described in pages 91–93. Outside the outer buoy of the gat, the southern, or flood stream, which runs during 6 hours in an irregular direction between west and south, begins here 2 hours before it is low water at Brouwershaven, and at the same time the water begins to rise.

The northern, or ebb stream, which runs 6 hours, in an irregular direction also, between east and north, begins outside the outer buoy 2 hours before it is high water at Brouwershaven ; and the water then begins to fall.

At sea, the stream of the northerly tide takes first an easterly direction, and runs into the gat, at which time vessels having an adverse wind may begin to work up the gateway towards Brouwershaven ; but as the latter part of the southerly tide sets directly across the Banjaard banks, seamen should be very cautious not to approach the North Banjaard before the northerly tide has begun at sea.

Inside the Hook of Schouwen it is high water almost an hour before it is high water at Brouwershaven, and the stream, drawing inwards, runs more regularly, taking the direction of the channel, both with flood and ebb.

OOSTER ZAND (Easter sand), extends 10 miles from Goeree, and forms the northern boundary of Brouwershaven gat, and the southern boundary of Goeree gat. Ooster zand includes the Middel plaat, Kabbelaars plaat, and all the sand on the north side of

Brouwershaven gat, as they are parted from it only by small blind channels.

The northern part of Ooster zand, sweeping round to the West gat of Goeree, has near its edge some patches which nearly dry; along this side of the sand the ground is soft, and the depths in many parts are irregular; so that it cannot be approached at night by the lead with safety.

At about one mile W. $\frac{3}{4}$ N. from the outer *black* buoy of Brouwershaven gat, is a small 5 fathoms patch, with 6 and 7 fathoms about it. A ridge of $4\frac{1}{2}$ fathoms in continuation of the Steen banks, lies out $1\frac{1}{2}$ miles from the outer edge of the North Banjaard.

Hompelvoet and Paarden plaat are shallow banks, the greater parts of which are bare at low water; they separate Brouwershaven road from Springer deep.

Dwars in Den Weg (athwart the way), is a bank for the most part dry at low water, lying E. by S. and W. by N. fronting Brouwershaven harbour; with a narrow channel between it and the southern shore, which is very shallow at its eastern end. The northern channel, forming Brouwershaven road, is again split into two branches; one of which, the *Vlieger*, runs between the Paarden plaat and Kabeljauws plaat into Springer deep, and the other between Dwars in den weg and Kabeljauws plaat, and so continues on to Grevelingen channel.

INNER CHANNELS.—Springer deep.—In the deep the depths vary between 4 and 14 fathoms, except at the entrance and the southern extremity, which have bars, and the passage is too intricate for any but those well acquainted. There are no marks, but the course of the deep may be observed; and, as the banks and flats which form the channel are high and steep-to, it is advisable to wait until they begin to uncover, so that the channel may show itself distinctly. This remark is also applicable to the other channels. In the south end of the Springer, between Veermans plaat and the Slikken van Flakkee (plaats of Flakkee), there is deep water, but the passage is very narrow, and has a bar with 7 feet over it.

Navigable depths in the inner channels.—In June 1892 the least depth in Dijkwater was $29\frac{1}{2}$ feet, and in Droogte van Bruinisse, $23\frac{1}{2}$ feet, with a rise of $8\frac{1}{2}$ feet.

Le Vlieger, the second channel, is between the Hompelvoet and Paarden on the north, the Dwars in den weg and the Kabeljauws

plaat on the south, and runs into Springer deep ; its sides are steep-to and the depths in it vary from 4 to $7\frac{1}{2}$ fathoms.

Another branch, between the Kabeljauws plaat on the north and Dwars in den weg, turns to the southward between the Veermans plaat and the shore of Schouwen, and runs by the Dijkwater onward to the road of Bruinnesse.

The Third channel, and where small vessels anchor, between the Dwars in den weg and the shore of Brouwershaven, is very narrow. A rocky shoal stretches out 155 yards from Ossenhoek, and requires attention. At the entrance of the channel, between Ossenhoek and the west end of the bank, there are 11 feet at low water ; but further on there are 5 and 6 fathoms, to abreast the Sluisje of Brouwershaven, where there are only $4\frac{1}{2}$ fathoms. From this part a narrow bank borders the shore, which, from the east end of Kykuitdyk (look-out dyke), extends further off, and forms with the east end of Dwars in den weg, a bar at the east end of this channel, on which there is about one foot. From Ossenhoek to the port there are posts to which vessels make fast when there is ice.

Directions.—Brouwershaven gat, from its depth and general character, is one of the safest ports on the coast of Holland for vessels of large draught ; by the aid of Renesse lights it may be entered by night.

The frequent changes in the banks and buoys render the aid of a pilot advisable.

Those in the offing approaching Brouwershaven gat will, if the weather be clear, sight Middelburg spire, Westkapelle light-tower, and the other objects in Walcheren, and then the lighthouse of Schouwen, which should be kept between S.E. and E.S.E. by those lying-to in the offing, and they should attend to the lead and not shoal the water under 10 fathoms.

Approaching the gat from the northward, to pass north-eastward of East Schouwen bank in about 7 fathoms, do not bring Schouwen lighthouse to the eastward of S.E. by S., until Schouwen light-vessel bears westward of S.W., when Schouwen lighthouse and beacon may be brought in line, bearing S.E. $\frac{1}{4}$ S., which leads to the eastward of the Middel bank in 11 and 12 fathoms, and up to the outer black buoy of the gateway, crossing a $4\frac{1}{2}$ fathoms patch, half a mile N.W. of the buoy.

Approaching from the westward, keep Schouwen lighthouse E. by S. $\frac{3}{4}$ S., and it will lead close to the south-westward of the shallow portions of the Schouwen and Middel banks in 6 fathoms. When Westkapelle bears S. by W. $\frac{1}{4}$ W., the latter bank will have

been crossed, and the outer buoy of the gat will then bear northward of East, about 6 miles. On nearing the gat the Banjaard buoys will probably be seen. It is not advisable to go nearer to that sand than the depth of 10 fathoms, as it is steep-to, until Renesse lighthouses appear in line.

From near the outer buoy of the gat the leading mark in, by day and night, is the Renesse lighthouses or lights in line, bearing E. by S. $\frac{3}{4}$ S. The lower of the two lights may be seen from 5 miles outside the gateway. When the gateway has been entered, it will be known by Goedereede light becoming obscured. Be careful in keeping the Renesse lights in line at the outer part of the gat, as the first two hours of the flood sets obliquely towards the Banjaard, and the first two hours of the ebb sets towards Ooster zand. The direction, as well as the strength of the streams is, however, influenced by the wind.

Proceeding towards Brouwershaven, the course is first about E. $\frac{1}{2}$ S., for $1\frac{1}{2}$ miles, to beyond the beacon buoy upon the Schaar of Renesse; from thence to abreast the Kloosternolle it is S.E. by E. $\frac{3}{4}$ E., for $2\frac{3}{4}$ miles, and then E. by S., for 2 miles, to Brouwershaven road. Having passed the beacon at the end of the jetty at Ossenhoek, and having Brouwershaven church bearing, S. by W., and Zierikzee church open a little to the westward of it, anchor in 7 fathoms. This is the best position in the roadstead.

At Night the Verklikker first appears on a S. by E. bearing, and serves as a caution to prepare to anchor. The anchor should be let go when the Schouwen light appears over the Verklikker S.W., and Renesse lights have been brought a little open to the northward; the latter lights in line would lead too close to the south shore. In the position thus indicated, there is a depth of $4\frac{1}{2}$ fathoms, and though it is not a safe anchorage at all times, it has the advantage of having a flat and partly sheltered strand closely adjoining, in case of accident.

Turning through.—To work into Brouwershaven gat with safety, a general acquaintance with the objects, as well as with the set of the tidal streams, is necessary. As there is a leewardly set in strong north-easterly winds, the gat should not then be attempted. There is scarcely a landmark by which a vessel's approach to the banks on either side may be known, therefore the buoys, and a strict attention to the lead, will be the best guides.

The outer part of Ooster zand, especially at the Rug van den Ooster, is too steep to be closed by the lead, and the south side of the channel is also steep along the Nieuwe sand between the second

and fourth *white* buoys. It is therefore necessary, in either case, to tack before the line of the respective buoys be reached. Above the fourth *white* buoy, and at the anchorage before referred to, the south shore is shelving, but it is advisable not to approach either side of the gat into a less depth than 4 fathoms. See page 17 for future buoyage.

Anchorage.—The best anchorage in Brouwershaven road is on the north side of the channel, where there is shelter from all winds except from W.N.W.; by going into the Vlieger and anchoring under the Paarden plaat you have better shelter, but it is further from Brouwershaven. It is not advisable to anchor off Ossenhook on account of N.W. winds and its being a lee shore.

GOEREE GAT.—The middle of the three outlets of the Maas running between the islands Goeree and Voorne, is known by the name of Goeree gat.

Navigable depths.—In June 1892 the least depth in Noorder gat was $8\frac{1}{4}$ feet; Bokke gat 14 feet; Slyk gat $17\frac{1}{3}$ feet; with a rise of $6\frac{1}{4}$ feet.

At Zuider Pampus $5\frac{1}{2}$ feet; Aardappelen gat, $17\frac{1}{3}$ feet, and at Bieneningen entrance, $5\frac{3}{4}$ feet, with a rise of $5\frac{1}{2}$ feet. A vessel of 17 feet draught can navigate the channel from sea to Hellevoetsluis at high water neaps, and of 14 feet draught at low water springs. The heaviest draught vessel that had visited the port was of 20 feet draught.

For tidal signals see page 22.

Goeree, which was formerly a distinct island, is now connected with the larger island Overflakkee; it is generally low, with high sand hills towards its western end, and along the northern face, to as far as Goeree canal, where the shore turns and trends southerly.

Voorne island, like Goeree, is fronted seaward by sand-hills. On the north-east side of the island, is the fortified town Brielle, the large square tower of the church of which is visible in clear weather at the distance of 16 miles.

HELLEVOETSLUIS, on the south-west side of Voorne island, is a strongly fortified town, with a large excellent harbour, the entrance being between piers extending a considerable way into the river, and is the sea outlet of the Voorne canal. Here is a royal dockyard, arsenal, and other establishments pertaining to a naval station.

Dock.—There is a government dry dock, with $17\frac{1}{2}$ feet of water over the sill, which can be divided into two, it is 500 feet long. The largest steam-vessel which has been docked was one of 1,200 tons.

Repairs.—No extensive repairs can be carried out at Hellevoetsluis.

Torpedo practice.—Periodical practice with torpedoes is carried out in the fairway near Hellevoetsluis.

Time signal.—The instant of mean noon is shown from the roof of the chief office of the Marine Establishment, by means of four discs, at a height of 60 feet above the ground.

The discs are placed perpendicularly at 5 minutes before the signal, and they fall into a horizontal position at the instant of noon, Hellevoetsluis mean time. Equivalent to 23h. 43m. 29·3s., Greenwich mean time.

VOORNE CANAL.—The entrance of the Voorne canal is just eastward of Hellevoetsluis, and from a short distance within the entrance the canal crosses the island in a straight line E. by N. $\frac{1}{2}$ N. By this route vessels may pass at all times in less than four hours from Hellevoet road into Maas river, 9 miles below Rotterdam. The canal was opened 1st November, 1830, and has proved of immense benefit to the trade of Rotterdam, about 3,000 vessels having passed through it annually. It has, however, now been superseded as the principal route to Rotterdam by the new canal through the Hook of Holland, known as the New Rotterdam canal or Nieuwe Waterweg.

The canal is about $5\frac{1}{2}$ miles long, and has double tidal locks at its extremities, 45 feet wide, and 232 feet long. The depth of water is purposely kept at not more than 17 feet, in order that the canal may carry off the drainage water of the interior of the island, but the level can be easily raised to 20 feet. The width at the surface of the water is 112 feet, and there are four expansions, or sidings, at regular intervals, to enable large ships to pass each other. Vessels of large draught have to lighten after leaving the canal before proceeding to Rotterdam. The canal is crossed by four floating bridges and one drawbridge, and it has a broad towing path on each side.

The canal pilots are furnished with the canal regulations in the French, English, and German languages, for the information of captains of vessels. To these regulations is fixed a tariff of charges for passing through the canal, including lock dues, port money, bridge tolls, &c., the amount of which varies according to the tonnage of the vessel, and the place lately arrived from.

LIGHTS—Goedereede.—At the eastern part of Goeree island, and 5 miles from its west end, stands Goedereede or Goeree church, with a massive hexagonal tower, one of the principal marks used in entering the Slyk gat; a *fixed white* light is shown from its summit, 148 feet above high water, and may be seen in clear weather at a distance of 18 miles. The light is visible from N.W., through West and South to East, and from E. $\frac{1}{8}$ N. to N.E. $\frac{1}{8}$ N., being obscured in the outer part of Brouwershaven gat, and eastward of Brouwershaven road.

Voorne canal.—At the mouth of the canal two *fixed green* lights are exhibited.

Jan Paulus (Flaauwe Werk).—Among the downs on the north shore of Goeree, is a small house named Jan Paulus, from which a *fixed white* light is shown between S. $\frac{1}{2}$ E., through South, and S.W. $\frac{1}{4}$ W., visible 8 miles.

Yzeren.—At $1\frac{1}{2}$ miles eastward of Jan Paulus is an octagonal, brown, iron tower (Yzeren beacon), and also a mast beacon with a diamond head. Upon the iron tower is shown a *fixed* light 90 feet above high water. It shows *white* between S.E. by E. $\frac{3}{4}$ E. and S.E. by S.; *red* between S.E. by S. and S. $\frac{1}{4}$ W.; *white* between S. $\frac{1}{2}$ W. and W. by S. $\frac{3}{4}$ S. Goedereede and Yzeren beacon lights in line, is the leading mark into the entrance of Slyk gat.

In clear weather the *white* light is visible 15 miles, and the *red* light 8 miles.

Goedereede harbour lights are *two fixed white*, W.S.W. and E.N.E. of each other.

Stellendam.—From a grey house, 15 feet above high water, on the extremity of the West mole at Stellendam a *fixed white* light is exhibited, visible in clear weather 8 miles.

On the head of the East harbour mole is a beacon with a *white* ball of open iron framework.

Bokke gat gas-buoys.—In the place of light-vessels two buoys painted *white*, each showing a *fixed white* light visible for 5 miles, are placed in the gat. The buoys are liable to change in position.*

Kwak Hoek.—A *black* buoy with Kwak painted on it, and lighted by gas, is placed in the Rak van Scheelhoek, the light is visible 5 miles.*

Hellevoetsluis.—At the west end of the harbour, is a circular, white, stone tower with black band, which, from an elevation of 51 feet, shows a *fixed white* light, with *red* sectors, visible seaward for 12 miles from West to S.E. $\frac{1}{2}$ S., the *red* light is visible 4 miles.

* See pages , for future buoyage

The *red* sectors are between the bearings E. $\frac{1}{2}$ S. and E. $\frac{1}{4}$ N., and between N.W. $\frac{1}{2}$ N. to N.W.

A fog bell on the East mole head is sounded in answer to signals from approaching vessels.

Horned heads (Hoornsche Hoofden) light, on the north shore of Haring Vliet, is a *fixed* light, *white* between S.E. $\frac{1}{2}$ E. and N.N.E. $\frac{1}{2}$ E., and *red* between N.N.E. $\frac{1}{2}$ E. and N.W. $\frac{1}{2}$ W.

A fog bell is sounded in answer to signals from approaching vessels.

Pilots.—Goeree pilots cruise in the neighbourhood of Dungeness, as well as to the north-west of Brouwershaven, within range of Schouwen light, and also in the offing abreast Slyk gat. See page 119.

HINDER BANK occupies nearly the whole space immediately seaward of Goeree and Voorne, and the channels from the sea towards Hellevoetsluis are only swatchways across.

This sand forms on its south side the Slyk gat; and the Bollen (which is working north-eastward) on its north-east side with the West plaat and Honden (Seal) plaat, the Nieuwe or Noorder gat, or North channel to Hellevoetsluis. A large patch, one mile long, and nearly a mile broad, named the Ribben, forming the inner portion of the sand, dries; to the south of the Ribben, and separated by Bokke gat lies the Garnalen plaat (Shrimp shoal), and Tonne plaat; between the body of the sands and the shore of Goeree from the Yzeren beacon, there is, for a distance of nearly 2 miles, only 3 to 7 feet at low water over a great portion of the banks. The north-west or seaward side of the Hinder, lies in an N.E. by E. and S.W. by W. direction, and the depths decrease gradually towards it, but during dark nights, it is not prudent to approach it into less than 6 fathoms.

Buoys.—Nieuwe or Norder gat buoy, *white* with *red* top, and staff with *black* flag is in $3\frac{1}{2}$ fathoms, with Goedereede light S. by W. $\frac{1}{2}$ W., and Brielle church S.E. by E. See page 17 for future buoyage.

Hinder Ribben buoy, *white* with *red* top, and staff with *red* ball and triangle, lies in 5 fathoms with Goedereede light S. $\frac{1}{4}$ W., and Brielle church S.E. by E. $\frac{3}{4}$ E.

Hinder or Ouddorp buoy, *black* and *white* chequered, with staff and *black* diamond, is in $4\frac{1}{2}$ fathoms, with Westhoofd S.S.W. $\frac{1}{2}$ W.

Goeree buoy, *red* with staff and *red* ball, lies in 5 fathoms, with Goedereede and Yzeren lights in line, and Westhoofd S. $\frac{1}{2}$ W.

Scheelhoek bank is a continuation of the Hinder to the south-eastward, and extensively occupies the space between Goeree and Hellevoetsluis; the passages going by the Slyk gat towards the latter place, are named Zuider diep, and Zuider Pampus, passing the south and south-east sides of the sand. A large portion of the Scheelhoek dries at low water, and its east and west sides are very steep.

These passages are more or less buoyed, they are laid down on the same principle, but, liable to constant changes, their positions are not given to prevent misdirection.

Buoys are placed along the south-west and south sides of the Scheelhoek and mark the Zuider diep.

Slyk plaat is in continuation of the Scheelhoek; it is equally extensive, a portion of it dries, and over a great part of the remainder a flat bottomed boat cannot pass at low water; it is separated from Voorne island by Haring Vliet.

Both the Scheelhoek and Slyk plaat are subject to frequent changes as respects shape as well as height. The north part of Slyk small plaat forms the south boundary of Hellevoetsluis road, and then the eastern side of the sand, which is steep, trends nearly direct for the jetties of Middelharnis harbour.

Channels to Hellevoetsluis.—The channels are named Slyk gat, Bokke gat, and Nieuwe or Norder gat, the least depths in which are given at page 126. They are buoyed on the Netherlands system (*see* page 17), and as they frequently change the buoys are moved accordingly.

For tidal signals, *see* page 22.

Tidal streams at Goeree gat.—It is high water, full and change, outside Goeree gat, at 2h. 0m., springs rise $7\frac{1}{4}$ feet, and at Hellevoetsluis at 2h. 30m., springs rise $5\frac{1}{2}$ feet.

In all the channels the flood of ordinary tides runs a little more than 4 hours, while the ebb runs for fully 8 hours; the water continues to rise only 3 hours during the flood, and with the ebb to fall about 7 hours, so that during the last hour of both flood and ebb, the stream runs with but little apparent variation in the depth of water.

About Goeree at neaps the tide usually rises $5\frac{1}{2}$ feet. Upon an average the water does not rise during the first hour and a half of flood more than one-fourth of its whole height; it attains its highest point during the succeeding 2 hours, and remains nearly at that level until the ebb makes.

During the first 2 hours of the ebb, the water does not fall more than at the rate of about 10 inches in each half hour, after which it

falls about one foot in the same space of time, till towards the last of the ebb, when the fall is again 10 inches per half hour.

Sometimes, however, owing to prevailing winds, the tides rise and fall with less regularity, particularly off Goeree, and the same cause will also influence their direction and velocity. With northerly and westerly winds, the flood runs longer and rises higher, while southerly and easterly winds equally affect the ebb.

The ebb stream of the river meeting the tide of the North sea (which runs athwart the mouth of the channels), usually causes a remarkable rippling, and the junction of the two streams of tide may be also discerned from the difference in colour of the river and sea waters. With strong westerly gales this disturbance approaches nearer to the edge of the bank than when the wind is blowing off the land.

The flood stream along the coast sets from the west end of Goeree, and follows, in part, the direction of the outer edge of the Hinder bank, or about E.N.E., but off Goeree, the first of the flood sets off shore.

DIRECTIONS.—In heavy weather, a vessel having the choice of entering Brouwershaven gat, should not attempt that of Goeree. No stranger should willingly enter without a pilot. One can generally be obtained at sea, and always from within the bar. For least depths in the several gats, *see* page 126.

By Slyk gat.—Vessels waiting tide to enter Slyk gat usually anchor outside the outer or fairway buoy, in 6 or 7 fathoms, with Goedereede church open to the eastward of Yzeren beacon bearing S.E. $\frac{1}{4}$ E.; or, should circumstances render it necessary to continue under way, then keep Goedereede church between Jan Paulus house and Yzeren beacon, and do not go into a less depth than 7 fathoms. When approaching the gat from the offing, keep Goedereede church bearing S.E. $\frac{1}{2}$ E., and it will lead to the outer or fairway buoy.

Entering the Slyk gat on an emergency without a pilot, the seaman should know what tide is running; during westerly gales, however, this is not so necessary as regards the height of the water, for it is then so pent up at the mouth of the gat, that there is scarcely any perceptible fall during the ebb. This is the case only when storms from the westward have lasted a couple of days or more.

The leading mark through the entrance of the gat differs according to the wind. With northerly winds, keep Goedereede church in line with, or to the eastward of Yzeren beacon S.E. $\frac{1}{2}$ E., until Jan Paulus house bears S. by E., steer up the gat about E. by S. by the

buoys. With a southerly wind, and especially with a flood tide, keep Goeree church on with or to the southward of Yzeren beacon S.E. $\frac{3}{4}$ E.; this will lead up to the outer *red* beacon buoy, from which steer up the gat as above.

By Bokke gat.—Having arrived at the outer fairway buoy of the Slyk gat (page 131), steer between the *black* and *white* buoys in the gat, into the north end of the channel between Voorne and the Scheelhoek. See page 17 for future buoyage.

Having arrived in the north channel between the shore of Voorne and the Scheelhoek, steer between the *white* buoys marking the east edge of the sand, and the *black* buoys lying upon the outer edge of the flat from Voorne to the north-west of Kwak Hoek, leave on the port hand the *black* gas-light buoy of Kwak Hoek, and steer for Hellevoetsluis road or harbour.

Noorder gat, formerly one of the principal passages towards Hellevoetsluis, between the north-east side of the Hinder and the western shore of Voorne, is constantly altering.

At night.—As the leading lights are only available for a part of the way through Slyk gat, it should never be attempted at night by strangers, except in case of emergency. Goeree and Yzeren lights in line bearing S.E. $\frac{1}{2}$ E. lead to Goeree buoy. The *red* sector of Yzeren light shows between S.E. by S. and S. $\frac{1}{4}$ W.

Hellevoetsluis road.—Anchorage may be taken anywhere between the shore and the buoys on the north side of the Zuid wal in a depth of 9 or 10 fathoms. The best parts of the road are on the east and west sides of the harbour, but right in front of the pier-heads the bottom is soft, and rendered foul by sunken wrecks, and ships are sheered about by eddies. With this exception the ground in the road is good, and there is room enough for 100 sail to ride in comparative security, but the anchorage is subject to the drawbacks of being exposed to westerly gales and the strong flood tides produced by them, and in winter to the drift ice of the river.

CHAPTER V.

GOEREE TO THE TEXEL.

VARIATION 15° West in 1892.

Decreasing $8'$ annually.

BRIELLE GAT, was formerly the principal channel of the Maas to Rotterdam and is indifferently termed the Brielle gat and Maas flats. Voorne has already been described (page 126) as a low island fringed with sand-hills on its seaward, or west and north sides, and principally distinguished by the massive tower of Brielle church, from the top of which a light was formerly shown. Steen beacon stands at the north-east part of the island.*

Brielle gat as the highway to Rotterdam is now superseded by the New Rotterdam canal, *see* page 134.

Brielle is situated on the northern part of Voorne island, about 6 miles within the bar of the gat of the same name; it is strongly fortified. All vessels that are able to cross the bar can reach this place. The northern entrance of the Voorne canal is $3\frac{1}{2}$ miles above Brielle.

At the north mole there is a *fixed red* and a *white* light, visible 4 miles.

At Nieuwe sluis there are two lights at the entrance of Voorne canal, the eastern light is *red* and the western *blue*.

Lifeboat.—At Langedoen, between Zeeburg and Steen beacon there is a lifeboat station.

MAAS FLATS.—The flats of the Maas extend 3 miles seaward of Voorne island, and the channels across them are not only shallow, but are subject to constant change.

Maas bank, nearly dry in places, extends $1\frac{1}{2}$ miles south-west from the Hook of Holland. Within the shoals the channel of the Maas is confined between the shore of Voorne and a flat projecting from it

* *See Admiralty chart:—Mouths of the Maas, No. 122; scale, $m = 1.0$ inch.*

near the beacon to the southward, and the Binnen Vlakte (inner flat) and flats from Rozenburg island to the northward and eastward.

Buoys.—Maas buoy is painted in *red* and *white* horizontal stripes, and moored northward of Nieuwe gat, with Goeree lighthouse bearing S.S.W., and church tower at Brielle S.E. $\frac{1}{8}$ E. See page 17 for future buoyage.

Maassluis buoy is *white* with a *red* top surmounted by a staff and triangle, moored off the entrance of Maassluishe gat, with Goeree lighthouse bearing S.S.W. $\frac{5}{8}$ W. and Brielle church tower S.S.E. $\frac{3}{4}$ E.

The gat and the channel as far as Brielle are buoyed as usual with *black* buoys on the eastward or port hand, and *white* buoys on the westward or starboard hand. As these buoys are altered with the changes in the banks, and their present position might continue for a very limited and uncertain time, it would be useless to describe them further.

Tidal streams.—It is high water full and change, at Brielle gat at 2h. 15m., and at Brielle at 3h. 0m.; springs rise 5 feet; at Rotterdam at 3h. 45m.; springs rise 7 feet.

In the channel the flood of ordinary tides runs for little more than 4 hours, and the ebb runs fully 8 hours, but during the last hour of both flood and ebb, there is little apparent rise or fall.

On Brielle bar, at neaps, the tide usually rises about 5 feet. The average rise during the first hour and a half of the flood is not above one-fourth of the whole height which it attains during the next two hours, and at which point it remains until the ebb makes. During the first two hours of the ebb the water does not fall more than at the rate of about 10 inches in each half hour, it then falls about one foot in the same space of time until towards the latter part of the ebb, when the fall is again 10 inches per half hour.

Along the coast the flood sets E.N.E. until opposite Brielle bar, when it runs N.E., following the bend of the Hook of Holland. Outside Maas bank the first of the flood sets on the shore, except during southerly winds, when it generally sets off. The tide stands at low water, practically for 3 hours at the Hook of Holland. See page 13.

Directions.—Brielle bar can be crossed at high water only by small vessels. The tidal stream setting across the outer part of Maas flat renders the passage of the bar difficult with some winds. The shifting nature of the banks, however, renders the employment of a pilot advisable.

NEW ROTTERDAM CANAL.—Consequent upon the difficulties and dangers attending navigation owing to the shoals which

encumber the mouths of the Maas, the government of Holland decided to cut a canal across the Hook of Holland to the river Scheur. This canal (formerly called the Hook of Holland canal) is sheltered at its seaward entrance by two jetties which project at nearly right angles from the shore, and forms the principal communication from the sea to Rotterdam.

Navigable depths to Rotterdam.—A vessel of $22\frac{1}{2}$ feet draught can navigate the channel from sea to Rotterdam at high water neaps, and of 19 feet draught at low water springs. The heaviest draught vessel that has visited the port was of $24\frac{1}{2}$ feet draught.

Ice.—The navigation from sea to Rotterdam is stated to be open at all times, in January 1891 (an exceptionally severe winter) it was open, at which time the Schelde was blocked.

TIDAL SIGNALS.—By day. See page 22.

NIGHT SIGNALS.—WHITE LIGHTS.

<div> <div>Upper Yard.</div> <div>Middle Yard.</div> <div>Lower Yard.</div> <div>19½ feet.</div> </div>				
20 feet.	22½ feet.	25½ feet.	28 feet.	30½ feet.
20¾ feet.	23¼ feet.	26 feet.	28½ feet.	31¼ feet.
21½ feet.	24 feet.	26½ feet.	29¼ feet.	32 feet.
22 feet.	24¾ feet.	27¼ feet.	30 feet.	32½ feet.

These signals are given for every 8 inches of tidal rise, whilst the depth is greater than $19\frac{1}{2}$ feet; they are shown from a mast on the north side of the canal entrance, when the tide gauge can be accurately observed.

LIGHTS.—Maas light-vessel is moored $7\frac{1}{2}$ miles N.W. by W. from the northern pier-head of New Rotterdam canal, and exhibits *four red flashes* in quick succession *every half minute*, followed by an eclipse of *about fifteen seconds*. It is elevated 36 feet and is visible 11 miles in clear weather.

The light-vessel, with main and jigger masts, is painted *red*, with a broad *white* streak, upon which, on either side, the name *Maas* is painted in *black* letters, and carries a *red* cylinder at the mainmast head as a day mark. A *white* riding light is shown from the fore stay.

NOTE.—When from any cause the *flashing* light cannot be exhibited, a *fixed white* light will be shown from the masthead, and *two white flares every ten minutes* from above the gunwale.

Should the light-vessel drift from station, the usual lights will not be exhibited, but a *fixed red* light will be shown from each end of the vessel. By day a red flag will be hoisted above the red cylinder at the masthead.

Should a vessel be seen standing into danger, a gun will be fired from the light-vessel, and repeated if necessary; and the signal flags J.D. of the International code “*You are in danger*,” will be hoisted and kept flying until answered.

A rocket immediately after a gun will indicate that assistance from the shore is required.

Fog signal.—A siren gives *four blasts* in quick succession *every two minutes*. Should the siren be out of order, a bell will give (as regularly as possible) *four strokes every half minute*.

Canal lights.—From the northern pier-head, in fine weather only, a fixed *white* and *red* light is shown, the *white* light is visible 10 miles, and the *red* light 4 miles between the bearings N.E. by E. $\frac{1}{4}$ E. and E. by N. $\frac{3}{4}$ N.

At 87 yards within the southern low water pier-head is shown a *white* light, visible 8 miles; but is obscured between W. by S. $\frac{1}{4}$ S. and S.S.W. $\frac{3}{4}$ W., to avoid being mistaken for north pier light.

On the north shore, *two red* leading lights are in line bearing E. by S. $\frac{3}{4}$ S., also, *two green* leading lights, in line bearing S.E. by E. $\frac{1}{8}$ E., and *two white* leading lights, when in line bearing N.N.W. $\frac{1}{2}$ W. to lead up the canal.

Two *red* lights are exhibited near Krimsloot.

Fog signal.—A horn, worked by steam, which during thick or foggy weather will give a blast of *three seconds* duration every *forty seconds*, has been established on the northern side of the entrance of the New Rotterdam canal.

Buoys and beacons.—A *red* buoy, surmounted by a *red* ball lies with the light on the northern pier bearing S.E. by E., distant 4 miles; and is for the purpose of marking the place where dredgings are deposited. See page 17 for future buoyage.

A *black* buoy, lighted by gas is the outer of the *black* buoys marking the north side of the entrance, and *white* buoys mark the south side. Beacons surmounted by balls are placed along the north pier, and beacons with triangles along the south pier.

Two *red* buoys are placed for vessels in quarantine.

ROTTERDAM, the second city of Holland, is upon the right bank of the Merewede, or Nieuwe Maas, 17 miles above the entrance of the canal. Like most Dutch towns, Rotterdam is extensively intersected by canals, some of which, from their ample width, might be termed havens, and several of them are deep enough to admit large vessels to lie alongside the warehouses in the middle of the town. These canals afford shelter when ice is in the river. Along the river-face is the fine quay named the Boompjes (little trees), $1\frac{1}{4}$ miles long, the channel in front of which carries 5 to 6 fathoms water.

There are extensive wet docks on both banks of the river with from $20\frac{1}{2}$ to 26 feet over the sill at high water. See Dock book.

A double row of buoys are moored in a sufficient depth of water to allow ships of large draught to lie afloat with access to both sides for lighters to come alongside.

The inhabitants of Rotterdam, who numbered 190,500 in 1886, are chiefly engaged in commerce, which is divided into three sections,—the foreign, Rhine, and inland trades. It sends to the Dutch eastern possessions, and to the West Indies, provisions of various kinds, spirits, wines, mineral waters, and manufactured goods,—in return for coffee, sugar, spices, cotton, dye-woods, &c. To England and Scotland, with which it carries on an extensive trade, it sends cheese, butter, flax, linseed, madder, garden seeds, gin, clover seeds, fruits, poultry, and large numbers of cattle and sheep. A good trade is also carried on with America, and the countries of Europe. Steam communication is maintained with London, Leith, Hull, Yarmouth, Dunkerque, Havre, Antwerp, and other parts.

The town is connected by railway with Amsterdam, 38 miles N.N.E., Utrecht, Antwerp, and thence to all parts of the continent.

In 1886, 3,763 vessels of 2,202,748 tons entered at Rotterdam.

Steam tugs are always at hand to assist vessels.

Docks and slips.—An iron floating dry dock is formed in two distinct sections which can be united so as to form one dock 452 feet long if necessary. The larger dock is 295 feet long and the smaller 157 feet, each being 67 feet broad. The depth on sill is about $20\frac{1}{2}$ feet. The larger dock is capable of lifting 4,000 tons and the other 2,000 tons, besides their own weight. The dock has been used by a vessel 354 feet long. For other docks and slips, *see* Dock book.

Repairs.—At Rotterdam, Charlois, and the vicinity there are several large shipbuilding yards, where vessels of 1,000 to 1,500 tons are built; also extensive factories for steam and other engines. At Fymoord, just opposite the city there is a large establishment where most of the government steam-vessels, also several monitors, have been built and fitted with engines, &c. Up the river there are numerous small shipbuilding yards and manufactories within easy reach of the city.

Coal for steaming purposes can be obtained in any quantity; coaling is performed either from barges; or, at the quays, alongside which there are depths of from 4 to 5 fathoms.

Time signal.—The signal is made daily, except Sundays, from the Port office, and consists of four black discs, which are placed perpendicularly, as preparatory, five minutes before the signal, and fall into a horizontal position at noon—Rotterdam mean time equivalent to 23h. 43m. 0.9s. Greenwich mean time.

Directions for New Rotterdam canal.—By day or night, make the Maas light-vessel, it will serve as an excellent guide to the entrance of the canal. Coming from sea the two *fixed red* leading lights on the north side of the canal in line bearing E. by S. $\frac{1}{2}$ S. lead in mid-channel through the West gat, until the two *fixed green* lights, to the eastward and also on the north shore, come in line, bearing S.E. by E. $\frac{1}{8}$ E., which leads up between the buoys to the inner end of the north jetty.

When entering the canal with scant depths, moor to the buoys eastward of Berghaven below the buoy with *green* light, in order to wait tide or unlade.

As the outer ground fronting the navigable channel continues to work towards the north, outside the jetties (dams), it results that the actual channel on the bar is narrow. With bad weather and a high

sea, it is advisable, in order to enter from the north, to take the head of the north jetty as close as possible, using all needful caution in doing so.

Strangers should always, if possible, employ a pilot, as the bar is liable to change, and sunken vessels may obstruct the fairway.

The COAST.—From the Hook (Hoek) of Holland an unbroken line of coast extends for 66 miles to Kykduin near the Texel, curving gradually from a N.E. by E. to a N.E. by N. direction, and presenting throughout a broad margin of sand-hills, bounding a low and wooded country. These sand-hills protect the country from inundation by the sea, which, it is an interesting fact to remember, has assisted in raising this barrier against its own encroachments : the sand is said to be gaining slowly in extent and stability seawards. The only objects which now and then tend to relieve the monotony of the scene for many miles are, the tower of a village church, with its bluff top or diminutive spire showing above the downs, some beacons, and some fishing boats drawn up upon the beach. It is worthy of remark, that along the whole of this extent of coast not the smallest portion of rock is found, and there is only one sandbank, the Petten Polder, detached from the shore. On the other hand, the coast is shallow throughout, the 10 fathoms line is about 4 miles from the shore off the entrance of New Rotterdam canal, gradually increasing its distance to 15 miles off north-westward and northward of Ymuiden, and is close to the edge of the banks off the Texel.*

The following is a description of the several objects, as they occur between the Hook of Holland and Kykduin, and which are useful in distinguishing the coast.

Monster, about 6 miles from the Hook, has a massive square tower ; Ter Heyde, near Monster, is a small village close to the shore, and $3\frac{1}{4}$ miles north-east of the New Rotterdam canal ; and Loosduinen, about 3 miles E.N.E., has a tower of similar character, with a small turret upon it.

Scheveningen, a bathing village in connexion with the Hague (Gravenhage), which is only 2 miles distant, has, owing to its vicinity to the royal residence and the seat of government, become a place of considerable importance ; it stands close upon the shore, and its

* See Admiralty charts :—North sea, No. 2,182*a* ; scale, $m = 0.1$ of an inch ; Dover and Calais to Orfordness and Scheveningen, No. 1,406 ; scale, $m = 0.1$ of an inch ; Scheveningen to Ameland, No. 2,322, scale, $m = 0.5$ of an inch ; and plan of Texel, No. 124, scale, $m = 2.3$ inches.

church has a tower surmounted by a spire. Extensive bath-houses and the king's pavilion are on the sand-hills just eastward of the village; and its numerous fishing vessels form at times a marked feature on the shore; the steeples of the Hague are also visible behind.

There is a signal, telegraph, and lifeboat station here.

Light.—From a dark brown tower on a sand hill at Scheveningen, a *revolving* light, showing *red* and *white* alternately *every half minute* is exhibited 157 feet above high water, and is visible 18 miles.

Rhine river.—Katwijk, 7 miles northward of Scheveningen, at the mouth of Rhine river, has to the southward of it an extensive bathing establishment; the church, with a tower surmounted by a small spire, is a large white building; there is also another church with a tower and spire 170 feet high. Between Scheveningen and Katwijk the steeples of Wassenaar, Volkenburg, and Katwijk-binnen (Inner Katwijk) may occasionally be seen.

There is a telegraph and lifeboat station at Katwijk.

Light.—A *fixed white* light visible 8 miles is shown from a sand hill south of the village, between S.S.W. and E.N.E., for fishing vessels.

Noordwijk ann zee, $3\frac{1}{2}$ miles from Katwijk, has a church with a belfry and a high-pitched roof. Noordwijk-binnen, close within it, has a massive square tower and stunted spire, and a small pinnacle about the middle of the roof of the nave. A small conical roofed building like a summer-house stands on the summit of a high sand-hill, one mile south-west of the village. The hummocks on the land here appear somewhat higher than the southward.

Light.—A *fixed white* fishing light, visible 8 miles, is shown from a beacon, north of the village, between the bearings S.S.W. and E.N.E.

Zandvoort, nearly 9 miles from Noordwijk, has a church with a spire, and a large white hotel with outbuildings, which bears, when in line with the church, S.E. by E. $\frac{1}{2}$ E. The steeples of Haarlem are nearly always visible inland of Zandvoort.

There is a lifeboat station at Zandvoort.

Light.—On a sand hill north-west of the village, is shown a *fixed white* fishing light, visible 8 miles.

Ymuiden.—Between Zandvoort and Wijk aan zee, about 5 miles from the former, is Ymuiden harbour or the entrance of the Amsterdam North sea ship canal. See page 142.

Wijk aan zee, $7\frac{1}{2}$ miles northward of Zandvoort, is distinguished by a sand-hill higher than the coast about it; this hill, when on an East bearing, or nearly abreast, has the tower of Wijk aan zee church showing over it. The land here appears double, and is distinguishable when coming in from sea by Haarlem church, which stands about 4 miles in the interior, with a spire in the middle of it, and also by the church of Beverwijk, 3 miles inland, with a tower topped by a dark coloured spire.

There is a lifeboat station at Wijk ann zee.

Egmond aan zee light-towers sometimes show very indistinctly on account of the whiteness of the sand-hills in the back-ground.

A *fixed red* light, visible 7 miles, between N. by E. and S.S.W. is shown, from the sand hills west of the village. The inner light is discontinued.

At Camperdown, 6 miles northward of Egmond aan zee the downs are higher than those on either side, and they may be seen at an offing of 20 miles, where the depth is 14 fathoms. The Camperdowns, also called the Schoorl downs, have not the same white appearance which characterises the sand-hills on the other parts of the coast; the darker colour of the former is due to the sand reed growing on them being much broader than elsewhere on the coast.

Between the Camperdowns and Petten village is an interval in the line of sand hills, and the land is here protected from the sea by a dike, named Hondsbossche Zeewering. Petten church with a small spire, and having some houses and windmills a short distance southward of it, stands where there is a wide gap in the downs. Close to Petten is a sand-hill, upon which will be seen, when abreast of it, a large building like a lighthouse.

There is a telegraph and lifeboat station at Petten.

Callentsoog is seen through a wide opening in the downs; the steeple of its church appearing on with the southern slope of the sand-hills to the northward of the village, serves as an useful mark to vessels rounding the Haaks. There is a telegraph and lifeboat station at Callentsoog.

About 2 miles northward of Callentsoog is a high sand-hill named Dubbelduin (double down), and one mile further on are two light beacons on the sand-hills, named the Groote kaap and Kleine kaap (great and little beacons), which, when brought in line, answer the same purpose as Callentsoog on with the sand-hills. The Groote kaap, 64 feet above high water, has a round head, and the Kleine kaap, 36 feet high, a square head; they stand 484 yards from each

other, bearing S.E. by E. Two conspicuous sand-hills a little to the northward of the kaaps are named the Bollen. Kykduin lighthouse stands at the northern extremity of the Sand-dike, a range of sand-hills in continuation of the Bollen, 4 miles from the Groote and Kleine kaaps.

Close to the sand-hill on which Kykduin lighthouse stands, are the two beacons, Schouten kaap and Kleine kaap, with the steeple of Huisduinen and a mill showing between and near them. Beyond these, the coast at the opening of the Texel trends easterly, and is lined with the houses forming Helder village, and the royal dockyard, &c., at Nieuwe diep. On approaching the coast near Kykduin with the lighthouse in sight, but before rising the sand-hills, the masts of the shipping at Nieuwe diep, with the churches and crane at Willemsoord,* soon appear; on nearer approach the fort on the highest sand-hill, with the low receding land to the northward breaking off at Texel gat, are easily distinguished.

Petten polder, a bank abreast Petten village, which formerly had 12 feet over it, has now nowhere less than 21 feet at low water. To clear this bank it is necessary to keep in a depth of not less than 10 fathoms. A *red* nun buoy with a cross, and named Petten polder, is moored outside the northern end of the shoal two miles off shore.

YMUIDEN, the outer haven of the Amsterdam North sea ship canal, is formed by two stone jetties, each 1,600 yards long, which extend from the shore at a distance of 1,300 yards apart, and converge so as to leave an entrance nearly 300 yards in width, enclosing a harbour 250 acres in extent, with a proposed average depth of 26 feet water, which has proved itself a place of considerable use as a harbour of refuge during gales.†

Vessels should not come within 100 feet of the jetty heads on account of loose blocks of concrete lying underwater.

A *red* and *white* chequered buoy marks the place for depositing the mud dredged up, lies 2 miles from the jetty.

The deep water channel from between the outer jetty-heads to the inner pier-heads, which forms the entrance to the canal, is nearly 300 yards wide. The inner piers are 200 yards apart, but the width of the channel is only 200 feet at their outer ends, and narrows to about 125 feet at their inner end between the shore and the locks.

* See Admiralty Dock Book.

† See Admiralty plan :—Ymuiden harbour, No. 850 ; scale, *m* = 9·6 inches.

Black buoys mark the north side and *white* buoys the south side of the deep water portion of the outer harbour. Vessels should avoid mooring outside the buoys, as the depths are irregular, especially in the north-west part, where sand is always collecting. The flood tide coming from the south-west strikes against the north jetty on the inner side, flows along it, depositing at its inner end the sand it brings with it; the stream then turns southward across the entrance of the canal, and is lost in the southern side of the harbour. Dredging is constantly going on to remove the sand. See page 17 for future buoyage.

With a heavy sea from north-west, the north jetty is covered by it, and it is not advisable to remain in the outer harbour, but to move into the canal outside the locks, where there is perfect security. Sailing vessels bound in under these circumstances must carry sail so as to have good way on and be under command while entering.

Navigable depths to Amsterdam.—Vessels of about 23 feet draught can navigate the North sea ship canal to Amsterdam. The heaviest draught vessel that has visited that port was 415 feet long, 48 feet beam, and of $23\frac{1}{4}$ feet draught.

Any vessel could enter Ymuiden harbour at high water neaps, and the least depth at low water springs is 23 feet (Sept. 1891). The heaviest draught vessel that has entered Ymuiden harbour was of $24\frac{1}{2}$ feet draught. Westerly gales sometimes decrease the depth at the entrance to Ymuiden, by upwards of one foot, but the depth is restored by dredging as soon as practicable.

The largest lock at Ymuiden is 394 feet in length, 59 feet wide, and has 23 feet water over the sill at low water.

A larger lock is under construction, to be 682 feet long, $78\frac{1}{2}$ feet wide, and a depth of 30 feet over the sill at low water.

Directions.—Although the entrance to the outer harbour is sufficiently wide, it is all important to pay attention to the tidal streams, which follow the direction of the coast, and are consequently setting across the entrance, with great force during the flood, for 2 hours after high water. The flood stream setting to the north-east is banked up at the back of the south jetty, and its direction becomes diverted along the jetty towards the offing; after having passed the end of the jetty, the stream thus increased at first inclines a little towards the entrance, but soon takes its normal course along the coast. It has already been stated that one portion of the flood tide enters the harbour and produces a counter current setting to the southward across the entrance of the canal.

With the flood stream, therefore, vessels entering have to pass close to the south jetty head, and with the ebb tide close to the north jetty head, having regard to the fact that the bow of the vessel is beyond the stream, while the stern is still in the full strength of it. When the flood is strong, the vessel should have at least a speed of 6 knots for running in. If the rate of the stream is not known or the vessel has not sufficient steerage way or steers badly, it is better to wait until at least half an hour after high water, or better wait until low water. When the vessel has passed the jetty heads, reduce speed to 3 knots and steer between the two lines of buoys. If intending to moor in the outer harbour, it must be borne in mind that the tidal signals only indicate the depth in the channel, and not beyond the buoys, where it is less.

By night, if the weather is fine, it is better to remain outside under steam, or to anchor in about 8 fathoms water, and wait for daylight to run into the harbour, and direct into the locks, and thus avoid the chance of damage.

LIGHTS.—The leading lights are *fixed white* bearing from each other N.W. by W. $\frac{1}{4}$ W. and S.E. by E. $\frac{1}{4}$ E., and are 612 yards apart; when in line they lead into the outer harbour.

The lights are on the south shore, and are respectively 136 feet and 169 feet above high water, are visible for 18 and 19 miles.

The lighthouses are painted with *white* and *red* horizontal bands.

On the head of the south jetty there is a *fixed* light showing *green* seaward and *red* inwards.

On the head of the north jetty there is a *fixed* light, *red* seaward and *green* inwards.

On the head of the north and of the south crib there is a *fixed white* light.

These last four lights are visible for a distance of 2 miles.

The Fog signal is a steam siren, which gives blasts as follows:—On the first appearance of fog and until steam has been got up, the siren gives *every five or six minutes, two* blasts, a high note followed by a low note, each of *two and a half seconds* duration, and separated by an interval of *three seconds* silence.

When steam has been got up, the siren gives *two* blasts *every minute* as follows:—A high note of *five seconds* duration; silence of *three seconds*; then a low note of *five seconds* duration; followed by a silent interval of *forty-seven seconds*.

Tugs.—Under all circumstances those in sailing vessels are recommended to take a tug before entering the outer harbour. They are admirably managed and the charge is moderate.

Firing practice is periodically carried out from Ymuiden fort, when measures are taken to ensure the safety of passing vessels.

TIDES.—It is high water full and change at Ymuiden at 3h. 0m.; springs rise $5\frac{1}{2}$ feet. With gales from seaward the tide rises sometimes 9 or 10 feet; and with strong land gales it does not rise more than $3\frac{1}{2}$ feet. The flood stream is generally stronger than the ebb. It does not begin to run till 4 hours after the water has begun to rise. It is slack water at the entrance of Ymuiden for one hour before and one hour after low water.

Tidal signals by day.—The depth of water at each change of two-thirds of a foot, in the buoyed channel is shown at the yard arm of the mast at the low lighthouse, south side of the canal entrance. See page 22.

Night signals.—The depth at low water at the corresponding hour of the day previous, will be indicated by *white* and *green* lights, preceded by a preparatory single light, shown from the same position as the day signals.

White (W) and Green (G) lights.

Pilots.—All the pilot vessels carry at the mast head a blue flag with their number on it in white. One vessel cruises in the English channel off Dungeness, and others off Ymuiden between Egmond aan zee and Zandvoort.

The Amsterdam North sea ship canal.—The trade of Amsterdam having been greatly on the decline, led to the construction of this canal, which was opened on the 1st November, 1876, thus joining Amsterdam with the North sea by a more direct and shorter communication than that through the Great North Holland canal, which is nearly 50 miles long, and involves navigating the channels between the shoals at the Texel leading to its entrance at Nieuwe diep, whereas, the Amsterdam North sea ship canal is only 15 miles long, and has its entrance at Ymuiden, bringing Amsterdam within $3\frac{1}{2}$ hours' passage of the North sea.

The canal is closed by locks. The space between the two inner piers and the locks is the inner harbour; on each side are posts for checking vessels by or for hauling alongside, while waiting for the locks to be opened, or if intending to remain in the inner harbour. When vessels have passed the locks, the navigation of the canal offers no difficulty. There is no current, and the depth is 25 feet throughout. The width at the bottom is 105 feet, and at the surface about 328 feet, increasing considerably in the vicinity of Amsterdam. Care is required in steering through the bridges, which turn on a wooden starling in the centre of the canal, having a passage on each side about 59 feet wide. The bridges are opened in a few seconds, but are kept closed for 15 minutes previous to the train crossing.

The canal also connects Amsterdam with the Zuider zee by locks, for the use of the numerous small craft and fishing vessels sailing between Amsterdam and the different towns on the shore of the Zuider zee.

Ice.—The navigation is usually kept open during the winter, but in the severe weather of 1890-91 it was closed a few days before the end of the year to the 26th of January following.

Canal regulations.—Every Commander of a vessel navigating the canal or using the harbours must be provided with a copy of the "Canal Regulations," and shall, on demand, produce it to the canal officials.

Coal.—At Ymuiden no coals are kept, and there are no facilities for coaling from the wharves. The coal has generally to be brought from Amsterdam by lighters, a distance of 15 miles.

AMSTERDAM.—The most important commercial city of Holland, is at the confluence of the Amstel and the Y, an arm of the Zuider zee; it is the largest town in Holland, and constitutionally its capital. The sea front of the city forms a nearly direct line of $1\frac{1}{2}$ miles in length along the Y, flanked at either end by docks, and intersected near the centre by the Dam rak, the principal outlet of the Amstel. The city is cut up into 90 islands by the canals, in which vessels are to be seen passing to and fro or loading or unloading in all parts of the city. Amsterdam is in telegraphic communication with all parts of the world. Railways connect it with all the first cities and towns of Holland, and the continent. By the Amstel, the Zuider zee, and various canals, Amsterdam has inland water communication with all parts of Holland, with the south part of Germany, and also Belgium and Austria. Population in 1885, 366,657 inhabitants.

Since the Amsterdam North sea ship canal has been dug, all the western portion of the estuary of the Y has been laid dry, and is under cultivation. The eastern part of the estuary is barred by a dike which has in the northern part of it three locks from 60 to 65 feet wide and deep enough to receive any vessel able to cross the bar of the Pampus, which has 9 feet water on it.

Vessels drawing 23 feet can lie at moorings in the Y and discharge their cargoes into lighters.

There being next to no current in the Y, it makes the labour of mooring and securing vessels alongside the quays very easy.

The central railway station is built on the dike which extends along the Y, and thus the railway crosses the entrances to the wet docks. As the trains are numerous, this causes considerable delay to vessels, for the locks can only open at stated hours for a short time.

Commerce.—The principal exports consist of butter, cheese, refined sugar, flax, cattle, sheep, madder, geneva, &c.; and the principal imports, coal, sugar, coffee, hemp, grain, linseed, tea, cotton, wool, hides, tobacco, iron, and iron manufactures, &c. In 1890, 1,797 vessels, with an aggregate tonnage of 1,153,626 tons, entered the port. The trade carried on by steam-vessels with the Dutch Indian possessions is very extensive; as also between England, France, Germany, Russia, Portugal, and the United States.

Wet docks.—There are several large docks or basins, with from $17\frac{1}{2}$ to 25 feet water, for particulars of which, *see* Dock Book.

Dry docks.—Netherlands dock is 402 feet long, and 56 feet broad, and can receive a vessel 393 feet long, drawing 18 feet water. The Koningine dock is 402 feet long, $63\frac{1}{2}$ feet broad, and can receive a vessel of the same length, of 17 feet draught of water. *See* Dock Book.

Repairs.—The Netherlands Government dockyard turns out vessels built for the Navy. Near the docks are several yards supplied with all necessities for repairing vessels or their engines and boilers. There is a floating crane capable of lifting 80 tons.

Coals and supplies.—English coal in lighters can always be procured, also German coal, either in lighters or from railway trucks. Stores of every description for shipping are to be purchased.

Time signal.—A time signal is erected on the public buildings, Commercial quay, at Amsterdam. The signal apparatus consists of four black discs of lattice work, $3\frac{1}{4}$ feet in diameter.

The signal is made once daily, as follows ; the discs are placed in a vertical position 5 minutes before noon, and fall into a horizontal position at noon, local mean time—equivalent to 23h. 40m. 21s. Greenwich mean time.

Longitude.—Although the meridian of Greenwich is adopted in the charts of the Netherlands Government, the longitudes given in their Maritime Notices is measured from Amsterdam, which is $4^{\circ} 53' 4''$ East of Greenwich.

Tidal streams between the Maas and Texel.—From the Maas northward, to a position 8 or 10 miles from Kykduin lighthouse, outside the influence of the channels through the Haaks, the flood stream, or northern tide, during the first five hours, sets N.E., and for a part of the sixth or last hour E.N.E. When near about high water, it trends to the East and E.S.E., and after continuing for a while in the latter direction, it goes round to S.E. until high water. The ebb stream sets S. by W. the first hour, veers round during the next four hours to S.W., and so to West and to the northward during the last hour, attaining a N.E. direction by the time the flood makes. Along the whole of this coast the tidal streams set 6 hours each way, but it is only during the first three hours of the flood stream that any rise is perceptible on the shore, the falling of the water lasting during nine hours. On full and change days, the flood begins at noon, and by 3 o'clock the tide has attained its maximum height between Scheveningen and Petten.

BROWN RIDGE.—About 3 miles northward of the parallel of Zandvoort, and on the meridian of $3^{\circ} 20'$ E., is the south end of a narrow ridge, which extends to the northward for upwards of 20 miles; about 10 miles to the eastward is another ridge, and between them a third, with general depths over them from 11 to 15 fathoms, and with deeper water between them. The soundings will be a guide to seamen when in this vicinity.

The TEXEL or Texel gat, upwards of 2 miles wide, is the important passage between the Helder and Texel island, and connects the North sea with the Zuider zee, the Nieuwe diep, and the Great North Holland canal leading to Amsterdam. The land bordering the gat, which embraces from Callentsoog to the Helder, has been described.* See page 141.

The south-west and north-west sides of Texel island are defended by sand hills like the coast to the southward. In the south-west part of the island are the villages Hoorn and Westen; the church tower of the latter, square and bluff, can be seen from sea only occasionally and in clear weather; that of Hoorn has a spire, and stands further southward. Upon the south-west shore are two sand-downs, rendered remarkable by the deep score between them, one is named the Heuvel, and the southern and larger Pietersduin; and these, with the aforementioned churches, form important leading marks in the navigation of the channels of the Texel.

About $1\frac{1}{2}$ miles N.W. by W. $\frac{1}{4}$ W. from Westen is a beacon on the sand-hills near the shore; and $3\frac{1}{2}$ miles northward of it is another near De Koog which is a rescue station, in telephonic communication with Den Burg. Off the south-west end of Texel island the fore-shore dries out about one mile, but on the opposite side of the gat the water is deep close to.

Navigable depths to Willemsoord.—The least depth (June 1892) was $21\frac{2}{3}$ feet on the inner bar of Schulpden gat; West gat $14\frac{3}{4}$ feet.

LIGHTS.—Haaks light-vessel is moored in 16 fathoms, with Kykduin lighthouse bearing E. by S. $\frac{1}{2}$ S., distant $15\frac{1}{2}$ miles.

From the mainmast, at an elevation of 36 feet above the sea (in bad weather 31 feet) is exhibited a *flashing white* and *red* light showing every *thirty seconds*:—*two white flashes*, in quick succession, then an eclipse of *ten seconds*, followed by a single *red flash*, all visible in clear weather 11 miles. A white riding light is shown from the fore-stay.

* See Admiralty chart:—Texel, No. 124; scale, $m = 2.4$ inches.

The light-vessel, with one mast and a jigger mast, is painted *red*, with the name *Haaks* in *black* letters on sides; and carries a *red* cone, point downwards, at the masthead as a daymark.

NOTE.—When from any cause the *flashing* light cannot be exhibited, a *fixed white* lantern light will be shown from the mast-head, and a *red* flare-up every 10 minutes from above the gunwale. If this light-vessel has drifted, the usual lights will not be exhibited, but a *fixed red* light will be shown from each end of the vessel. By day a *red* flag will be hoisted above the *red* cone at the mast-head. Should a vessel be seen standing into danger, a gun will be fired, and repeated if necessary; also the signal flags J.D. of the International code, "*You are in danger*," will be hoisted and kept flying until answered. A bright rocket immediately after a gun will indicate that assistance from the shore is required. To mark the position of the light-vessel, two anchor buoys, both painted *red* with a *white* horizontal stripe, and with H. No. 1 and H. No. 2 on them, respectively, in *black* letters, are moored North and South, distant three cables from each other.

Fog signal.—A siren gives *two blasts* in quick succession every *two minutes*. Should the siren not be ready for use, or be out of order, a bell will give *two strokes* in succession, followed by a pause, every *thirty seconds*.

At Zanddijk, at the southern entrance of Schulpen gat are two wooden light-beacons, 484 yards apart, in a N.W. by W. and S.E. by E. direction. Both lights are *fixed*, the eastern one is 64 feet above the sea, and visible 13 miles, and the western one 36 feet above the sea, and visible for 10 miles, between the bearings E.S.E. and S.E. by S.

Falga light, $1\frac{1}{2}$ miles S.S.W. of Kykduin, is *red* and *green* and shown from a *black* square frame. *Green* between N. by E. and E. by S., and *red* on other bearings.

The *red* light is visible 6 miles, the *green* light 4 miles.

Dirkoomsduin, on the sand-hills, 613 yards south-west of Kykduin, is a *fixed white* light which, from an iron tower elevated 61 feet, can be seen 12 miles between the bearings E.N.E. and N.N.E. In line with Kykduin light, it leads to the outer buoy of Schulpen gat.

Kykduin lighthouse is a sixteen sided iron building, 182 feet high, painted *brown*, standing about N.E. $\frac{1}{2}$ E. one-third of a mile from the battery on the highest part of the downs. It exhibits at 187 feet above high water, a *fixed white* light, visible 20 miles in clear weather.

Nieuwe diep, on the western pier-head of Nieuwe diep are two harbour lights, 73 yards from each other, S.W. $\frac{1}{2}$ S. and N.E. $\frac{1}{2}$ N. Both lights are *fixed*, the higher is *red*, and the lower (Wierhoofd) *white*; they are respectively 35 and 29 feet above high water. The *white* light is visible 8 miles, the *red* light 2 miles.

Schilbols nol and Stuifdijk leading lights for inner bar of Schulpen gat are on the south side of Texel island. The lights are *fixed* and exhibited respectively at 28 and 21 feet above high water, and can be seen in clear weather at respectively 10 and 9 miles. They bear N.E. and S.W. from each other, and are 765 yards apart.

Helder dike is *fixed white*, elevated 45 feet above high water, 137 yards N.W. by N. from Kykduin high lighthouse, in line with which on a S.E. by S. bearing it leads into Molen gat, an unbuoyed fairway westward of Onrust shoal. The light is shown from a wooden post with a shed at its base, the whole coloured *yellow*.

PILOTS.—The Texel pilot vessels, yawl rigged, cruise in the English channel near the Isle of Wight. The coast pilot boats are always cruising near the entrance of Schulpen gat, unless driven in by south-westerly gales, when the strong flood tidal stream which then exists renders it next to impossible for a vessel to maintain her position. These boats termed Rinkelaars, have a round stern, the name *Texel* is painted in large letters on the mainsail, and they carry a blue flag with a white number on it.

Tugs.—There are steam-tugs at Nieuwe diep, which may be obtained by vessels in the offing showing two flags,—one at the masthead, the other 4 or 5 feet below it. This signal may be made as soon as Kykduin lighthouse is well in sight, from whence it will be repeated by a ball. The lowering of the ball is a signal that the steamer is on the way out; but should a red flag be hoisted, it denotes that the desired assistance cannot be rendered.

HAAKS BANKS.—The approach to the Texel from the North sea is beset with difficulties, it being obstructed in every direction by sand-banks, which, comprised under the general application of the Haaks, forms a barrier crossing from the south-west to the north-east, fully 12 miles in extent. These sands have but from 6 to 3 feet water over a great portion of them and in some places are dry at low-water. They are divided by several navigable channels. Upon their west or seaward side, the Haaks fall almost perpendicularly into a depth of 10 and 11 fathoms, their surface is subject to frequent alteration, and these features are rendered the more dangerous on

account of the distance to which the sands lie out from a low coast of great uniformity of appearance. The principal channels into the Texel—namely, the Schulpden gat, the S.W. gat or Slenk, and the West gat (at present unbuoyed) on the south-east, the west, and north sides of the South Haaks.

The following is a brief description, avoiding minor and confusing details, of the two divisions of the Haaks; the gats are marked in accordance with the Netherlands system of buoyage (*see* page 17), the buoys are moved as the channels change, so that the positions of the outer ones only are given.

Light-vessel, *see* page 149.

South Haaks occupy a triangular space, extending from near the Bollen, where one side is presented to the south-westward, and the apex is close in shore abreast Kykduin. Each side of the sand may be considered as about 4 miles in extent; its highest, or shoalest portions are the Wittetons rug (Whitebuoy ridge), and the Bollen, with 12 to 4 feet upon them. These two portions are separated by a swatchway named Wagonpad. An extension, or bar, named the Rug, connects the north-east extremity of the South Haaks with the shore within Kykduin.

Outer, No. 1 buoy, a *black* nun, lies in $4\frac{1}{2}$ fathoms at the south-west angle of the South Haaks with Zanddijk beacons in line S.E. by E., about 2 miles.*

A large *red* and *white* horizontally striped nun buoy named Zuider (South) Haaks, with a *red* half ball, lies in 10 fathoms with the Zanddijk beacons nearly in line S.E. $\frac{3}{4}$ E. distant above 5 miles.*

North Haaks are rather more extensive than the South Haaks, but, like the latter, are triangular in shape, with a ridgy shallow extension from their northern extremity, named Ezels bank, fronting the western part of Texel island, and extending past it for some distance north-eastward. The surface of the North Haaks is exceedingly irregular and shallow. The highest portions are the Onrust, on the north-east side, which dries 6 feet at low water over a considerable space; the Middel rug, upon the south-west side, which has, for the most part, 10 and 12 feet over it, and dries at its eastern end; and the Laan, a long and narrow ridge of from one to 6 feet, at the south-east extremity of the North Haaks.

The Noorder (North) Haaks buoy is vertically striped *black* and *white*, and surmounted with a *black* ball; from it Hoorn spire bears E. $\frac{1}{4}$ N., distant $6\frac{1}{2}$ miles.*

* *See* page 17, for future buoyage.

Haaks buoy is a large *white* buoy, with a staff and *black* flag, lies with Hoorn spire bearing E. $\frac{3}{4}$ N., distant nearly 8 miles.*

Middel Rug buoy, *red*, surmounted by two *red* balls lies with Hoorn spire bearing E. by N. $\frac{1}{2}$ N., distant $8\frac{1}{4}$ miles.*

Refuge beacon.—A wooden refuge beacon stands on the southern or outer edge of the dry part of the Onrust, with Hoorn church bearing N.E. and Kykduin lighthouse S. by E. $\frac{1}{2}$ E. The floor of the chamber is about 13 feet above high water and the top 21 feet.

Fransche bank (French bank) and the flats from the shore form the south-east side of Schulpen gat. The Fransche is a detached 20-foot ridge, narrow, but nearly one mile long, and nearly connected with the south-west extremity of the South Haaks by a ridge of 24 feet, which may be considered as the outer bar of Schulpen gat.

Tidal streams of the Texel.—It is high water, full and change, outside the shoals at the entrance of the Texel at 6h. 30m.; off Noorder gat at 6h. 45m.; at Nieuwe diep at 7h. 27m.; and in Helsdeur road at 7h. 25m. In the channels spring tides rise 4 feet; neap tides rise $3\frac{1}{2}$ feet. Westerly gales usually cause an increase of about 8 inches. Practically the tide stands at high water for 3 hours at the Texel. See page 13.

Near the mouth of the channels, the latter part of the ebb stream trends to the north-west, and at the same period of the flood the stream runs S.E.; this last portion of the flood, which is called the land tide, causes the water in the channels, the height of which had for a while been stationary, to rise 4 inches more.

In Schulpen gat, the stream sets generally in the direction of the channel; but from the entrance to as far as the fourth *black* buoy, both flood and ebb rather incline towards the side of the Haaks, and at the inner part of the channel somewhat towards the *white* buoys.* At the bar or Drempeel it is never slack, the flood and ebb succeeding each other without intermission. At the entrance of the gat and at Nieuwe diep both tides run six hours, except during strong winds. During the prevalence of gales from N.W. or S.W., it is estimated that the flood runs 8 hours, and the ebb for 4 hours. At such times the ebb stream is weak, while that of flood acquires an increased velocity. When the ebb stream is increased by a freshet, its course along the sea-wall of Helder is extremely rapid.

In the Helsdeur the rise and fall each hour is as follow :—

			Rise. ft. in.				Fall. ft. in.
During the 1st hour of flood			- 1 2	During the 1st hour of ebb			- 0 8
" 2nd "			- 1 9	" 2nd "			- 0 10
" 3rd "			- 0 5	" 3rd "			- 0 10
" 4th "			- 0 2	" 4th "			- 0 8
" 5th "			- 0 2	" 5th "			- 0 6
" 6th "			- 0 4	" 6th "			- 0 6

* See page 17, for future buoyage.

DIRECTIONS for approaching the TEXEL.—Schulpen gat lies 68 miles N.E. $\frac{1}{2}$ N., from the Hook of Holland; 150 miles E. by N. $\frac{1}{4}$ N. from the North Foreland; 125 miles E. $\frac{1}{2}$ N. from Orfordness; 110 miles E. $\frac{1}{2}$ S. from Lowestoftness; and 190 miles S.E. from Flamborough head.

The steep and dangerous character of the Haaks has already been adverted to. It may also be added, that though landmarks abound, and the land between Callentsoog and Kykduin, termed the Sand-dike, will be visible in clear weather at the distance of 14 or 16 miles, yet with the least haze no more is to be seen here than on other portions of the Dutch coast under similar circumstances; namely, an indistinct waving line. At such times it is necessary to be extremely cautious, particularly as the stream of flood sets to the north-east, and the lead gives no warning of the approach to the west side of the banks.

From the above remarks it will be seen that it is advisable for strangers not to attempt any of the channels leading to the Texel without the aid of a pilot.

From the Southward.—Those from the English channel, bound to the Texel, should not make the land further north than Egmond aan zee or Camperdown, as there are situated the best distinguishing marks on the coast. Caution is necessary not to mistake Camperdown for Kykduin, *see* page 141, because between Camperdown and Petten, or the downs of Callentsoog, the land is so low that it appears like the entrance to a spacious harbour. It is advisable during the winter season not to go into less than 13 fathoms, which is a safe depth for rounding the Haaks, either to the northward or southward; and it is also to be noticed, that to the westward of the Haaks the streams of flood and ebb run nearly parallel to the western edge of the sands, that is, N.N.E. and S.S.W.

On ordinary occasions, having sighted Callentsoog village, and not having gone into a less depth than 10 fathoms, in order to avoid Petten polder bank, the great and little beacons will be seen about 3 miles to the northward, and afterwards the lighthouse of Kykduin. Should the day be too far advanced to proceed in, then stand off and on during the night, with Kykduin light between East and N.N.E., in not less than 12 fathoms, and bear in mind while in this position, that the stream of flood sets N.E., or right towards the South Haaks, and the ship's head should then be laid so as to stem the stream.

In the fine weather of summer, instead of lying-to in the offing, anchor outside Schulpen gat with Kykduin lighthouse N.E. by E., and Callentsoog steeple S.E., in 8 fathoms, about 3 miles off shore.

In winter (when of course no vessel should anchor) a blue flag hoisted at Kykduin is a signal that the channels are encumbered with ice.

From the North-eastward.—The approach to the channels of the Texel is difficult from the north-east, and great caution is necessary, the course lying along a chain of low islands, having few objects to distinguish them, where the irregularity of the tides baffles ordinary calculation, and where the approach to the land is rendered additionally hazardous by extensive sand-banks, and the prevalence of westerly gales and hazy weather. It becomes necessary in closing the land under such circumstances, and not having sighted the lights of Terschelling and Vlieland, to be very guarded against errors of longitude, for a mistake of a few miles might prove fatal, vessels seldom escaping immediate destruction when driven ashore in this vicinity in hazy weather. *See* caution, page 160, also De Horst, page 161.

By night.—Rounding Texel island from the north-eastward during the night, be cautious not to shoal the water under 13 fathoms, so as to avoid the Eierland grounds, and the Ezels at the North Haaks, as the stream of flood sets directly towards them, and they are consequently specially dangerous in thick weather. If the lights of Terschelling and Vlieland have not been sighted, then make the Haaks light; and be careful to keep in at least 13 fathoms while rounding, until to the southward of the Texel, or till Kykduin light bears to the northward of East, for, as before observed, 10 and 11 fathoms are close to the edge of the sands, and south-westerly gales have the effect of raising the water considerably, and thus deceiving as to distance.

SCHULPEN GAT (or Shell gat) is the best of all the Texel channels, and that generally used. It extends N.E. by N. for 4 miles close along shore, and is direct, and simple of use. Between the south part of the South Haaks and Fransche bank the width is about half a mile, and the depth upon the outer bar is 23 feet; within, the breadth decreases gradually to one-third of a mile, and the depth varies from $4\frac{1}{2}$ to 11 fathoms, and to 6 fathoms near the bar or Drempeel, where, in June 1892, the depth was $21\frac{3}{4}$ feet.

From the Drempeel the shore of Helder to Nieuwe diep is steep-to. The course, after the Drempeel has been cleared, continues round Kaaphoofd into the Helsdeur, or channel between the Helder dike and Laan, which is three-quarters of a mile wide, with 12 to 20 fathoms in it, and an extension of it, under the name of Mars diep continues along the shore of Texel island, while to the

south-eastward it proceeds along the shore of the Helder towards the Balg, this latter channel being divided from the former by the western extremity of Lutje waard flat, named the Bollen, which is marked by a *red* buoy lying in 20 feet.*

Torpedo practice is periodically carried out in Schulpen gat, off Kykduin, the area used being marked by buoys. When the torpedoes are charged, warning will be given by a torpedo vessel carrying a *red* flag at the masthead; also off the East battery, Willemsoord, the outer limit of the experimental area being marked by *black* and *white* chequered buoys. Firing is also periodically practised from Harseens fort, at which times a *red* flag is hoisted on the fort, and navigation of the Texel stroom is unsafe. A *red* flag is hoisted at the refuge beacon on Onrust while firing practice is being carried on there.

Directions through Schulpen gat.—When approaching Schulpen gat from the offing, Callentsoog steeple just clear of the sand-hill S. by E. $\frac{3}{4}$ E., and the beacons of Zanddijk in line S.E. by E. lead westward and south-westward of the South Haaks. Kykduin lighthouse N.E. $\frac{1}{4}$ E. leads just westward of the outer *black* buoy, from which the two lights at Zanddijk are in line.*

A mark to lead up to the outer buoy and into the gat, is the tower of Westen, in Texel island, appearing in the score between the Heuvel and Pieters duin, N.E. by N. This tower will be known by its stunted spire, while that of Hoorn, a little to the eastward, has a spire. Having entered, all the *black* buoys are to be left on the port hand. The above mark will lead to abreast the sixth *black* buoy.

When Schilbols nol and Stuifdijk lights on the south part of Texel island are in line bearing N.E. keep them so and steer between the *black* and *white* buoys marking Drempeel channel. On the bar in June 1892, the depth was $21\frac{3}{8}$ feet, and here, in light winds, special attention must be paid to the steerage, for the channel is narrow, and the tide is rapid and sets across.

From abreast Kaaphoofd to Helsdeur road, the course is E. by S.; the Helder dike is bold, and may be approached to one cable, and when passing Nieuwe diep keep at the same distance from the pier-heads, so as to avoid a sandy spit westward of the West pier.

By night.—The leading mark for the entrance of Schulpen gat is Dirkoomsduin and Kykduin lights in line bearing N.E. until Zanddijk lights are in line, then steer N.N.E. for nearly one mile until Schilbols nol and Stuifdijk lights on the south side of Texel island

* See page 17, for future buoyage.

are in line bearing N.E., then keep them so to pass mid-way over the inner bar, and when Wierhoofd (Nieuwe diep lower) light is seen, keep towards Helsdeur roadstead; or, Schilbols nol and Stuifdijk lights in line will lead through the whole length of the gat.

Caution.—Should the Drempeel be passed through at the beginning of the flood, the ebb stream will be found sweeping with full force past the Helder dike towards West gat, and if the wind be too light to enable the vessel to make head against the stream, anchor at once to prevent being driven down the Breewijd.

Oude West gat.—This channel becoming less serviceable owing to the continual shifting northward of the sands and shoaling of the water, in 1885 the buoys were taken up.

S.W. GAT (Nieuwe West gat).—In consequence of the water on the bar having shoaled and other changes in the West gat, the S.W. gat or Slenk on the south side of West gat and to the westward of Wittetons rug, has been buoyed with *black* buoys on the west side and *white* buoys on the east side. The course through is N.E. by E. $\frac{1}{2}$ E. with Hoorn church in line with De Heuvel. In June 1891 the least water in the gat was $14\frac{1}{4}$ feet. See page 17, for future buoyage.

HELDER and NIEUWE DIEP.—The Helder is a strongly fortified military post, commanding the channel into the Zuider zee, as well as Nieuwe diep. There is very little trade.

Nieuwe diep, the outlet of the Great North Holland canal, has been made to serve the purposes of a harbour. It is rather more than one mile in length, running in first S.W. by W., and then S. $\frac{1}{2}$ E. and S. by E. $\frac{1}{2}$ E., and its depth admits of vessels passing through at all times. The greatest length of any vessel which can enter the inner harbour is 218 feet, and the greatest draught $18\frac{3}{4}$ feet. The royal dockyard is on the west side of Nieuwe diep.

Time signal.—Four black discs on the roof of the chief marine establishment at Nieuwe diep, 57 feet above the ground, are placed perpendicularly at five minutes before noon, and fall into a horizontal position at noon, Nieuwe diep mean time. Equivalent to 23h. 40m. 53.6s. Greenwich mean time.

Docks.—There are two docks at Willemsoord, the larger is 361 feet long on the blocks, 64 feet wide at the entrance, and has $19\frac{1}{2}$ feet on the sill at high water.

Coal.—There are 500 tons of coal always in store for steam-vessels, but they have to coal from lighters.

HELSDEUR ROAD, or Texel road, is north-eastward of Nieuwe diep, between the Bollen and Zuidwal, or northern edge of Balg zand. The ground, a soft clay, is indifferent holding; West and W.N.W. winds sends a heavy swell in, and the anchorage should only be used for a temporary purpose by vessels bound up the Zuider zee. If bound to Nieuwe diep, the best plan is to enter it at once, if a pilot is on board.

A small shoal patch of 23 feet lies in the road with Helder church tower bearing W. $\frac{1}{4}$ S. distant $2\frac{1}{10}$ miles; and a stony patch of 9 feet, lies in Mars diep, $3\frac{1}{2}$ cables S.S.E. $\frac{1}{2}$ E. from the Outer Horntje beacon.

Submarine mines.—Buoys are moored respectively S.S.W. two cables from buoys Nos. 8 and 9, the enclosed space of these four buoys is used for torpedo practice, and is unsafe for navigation.

GREAT NORTH HOLLAND CANAL.—This work, which has its outlet at Nieuwe diep, was constructed between the years 1819 and 1825, and enables ships to pass up to Amsterdam, and thus to avoid the shallow and intricate navigation of the Zuider zee. This canal is now, to a great extent superseded by the Amsterdam North sea ship canal, *see* page 146.

The length of the canal is $49\frac{3}{4}$ miles, the width at the surface was originally 123 feet, but has been much increased in some places, and the depths are from 18 to $19\frac{1}{2}$ feet. The canal is divided into three sections, communicating with each other by means of locks, the locks are double, that is, there are two in the breadth of the canal. The larger lock at Willemsluizen is 358 feet long and $59\frac{3}{4}$ feet wide; that at Purmerend is 214 feet long and $51\frac{1}{4}$ feet wide; that at Zijper-schutsluis is 381 feet long by $50\frac{1}{2}$ feet wide, this lock is generally open, as the second and third sections of the canal have usually the same level.

The lock at Koopvaardersschutsluis, by means of which vessels pass out from the third section of the canal to Nieuwe diep, is $228\frac{1}{3}$ feet long and $55\frac{1}{4}$ feet wide; longer ships must await a "free lock."

The canal is crossed by three double turning bridges, situated respectively at Buiksloot, Purmerend, and Alkmaar, also by several floating-bridges. The railway also crosses the canal by swing bridges at De Kooi, Alkmaar, and Purmerend.

There are canal pilots, and no vessel drawing more than $11\frac{1}{2}$ feet is allowed to pass through the canal without one on board; these men are provided with copies of the canal regulations, in French, English, and German.

The ZUIDER ZEE.—The passage to Amsterdam through the Texel stroom and Zuider zee is only to be undertaken with the aid of a pilot and in small vessels, for the Zuider zee is full of shallows, and though the river in front of the city of Amsterdam has 23 feet water in it, only vessels of moderate burden and of not more than 9 feet draft are able to reach Amsterdam by this route. *See page 147.*

The Texel stroom, about 9 miles in length and one in breadth, is a continuation of Mars diep and Helsdeur road ; it is deep and navigable for large ships. Its direction is first along the south-east side of Texel island as far as Oude Schild lighthouse, it then bends gradually between the sands to East and E.S.E. for about 7 miles, when it suddenly turns to the southward and becomes so intricate that its navigation is impracticable without a pilot. From Oude Schild the channel is marked by *black* buoys on the north side and *white* buoys on the south. *See page 17, for future buoyage.*

CHAPTER VI.

TEXEL TO THE ELBE, INCLUDING HELIGOLAND ISLAND.

VARIATION $13\frac{1}{2}^{\circ}$ West in 1892

Decreasing about 8' annually.

TEXEL ISLAND, the south-westernmost of the group of islands off West Friesland, has a general direction N.E. and S.W., it is 12 miles long, and 5 miles across at the broadest part; its north-eastern part is composed of the former island, Eierland or Eggland, which was so named from the number of sea-birds' eggs found upon it; considerable numbers of sheep, cattle, and horses are reared upon Texel island, and Den Burg is the market town.*

The objects upon the south-west end of Texel island, and its separation from North Holland by Mars diep, have been noticed in the previous chapter. It is also divided from De Horst of Vlieland by a narrow and intricate passage named Engelschman gat, which is unbuoyed, and only used by small coasters of light draught.

Caution.—The islands Texel, Vlieland, and Terschelling, together form a salient point to those proceeding coastwise from the south-westward or north-eastward; when rounding them do not approach

* See Admiralty charts :—North Sea, No. 2,182*a*; scale, $m = 0\cdot7$ of an inch; and Scheveningen to Ameland including the Zuider zee, No. 2,322; scale, $m = 0\cdot5$ of an inch.

in less than 13 fathoms water, especially at night. A want of caution is often displayed in this respect, and much loss has been the result.

LIGHT.—At the north-east extreme of Texel island is a *red* stone tower, with a *white* band under a *black* gallery, 112 feet high, from which is exhibited a *flashing white* light, showing brightly for a duration of *ten seconds*, followed by an eclipse of *fifty seconds*, the light is visible in all directions except where obscured by the sand-hills of Texel and Vlieland, which lie north-east and south-west of the light; it is elevated 165 feet above the sea, and should be seen in clear weather from a distance of 19 miles.

This is also a telegraph and signal station.

Lifeboats.—There is a station at Koog, about the centre of the west side of the island; a second at Eierland lighthouse; and a third near Cocksdoorp on the north-east side of the island.

VLIELAND is about 10 miles long E.N.E. and W.S.W., $1\frac{1}{2}$ miles broad, and its eastern end is 5 miles from Terschelling. The island is generally low and sandy, except at its eastern end, where there is a village, lights, a windmill, and several beacons.

Extending 4 miles from the west end of Vlieland is a low sandy waste named De Horst, for the most part only 4 to 5 feet above high water; and as this portion of the island is not visible a few miles in the offing, a fictitious breadth is thereby given to the opening between Vlieland and the north part of Texel island, which has often been the cause of loss, from the seamen having mistaken it for the Texel. To remedy this, a beacon 23 feet high, with a square top, has been erected on the western extremity of De Horst.

The diamond-shaped beacon on the north-east end of Vlieland, in line with Duinkaap S. $\frac{5}{8}$ W., leads to the buoy of the Noorder gronden.

The Strand beacon in line with Duinkaap, S.S.E. $\frac{3}{8}$ E. leads to the outer buoy of Stortemelk.

LIGHTS.—The principal light at Vlieland shows *fixed red* from the bearing S. by E. $\frac{3}{8}$ E., through east, to E. $\frac{1}{2}$ N.; *fixed white* from E. $\frac{1}{2}$ N., through north, to S.W. by W.; and is eclipsed from S.W. by W. to S. by E. $\frac{3}{8}$ E. It is elevated 159 feet above the sea, and should be visible in clear weather, the *red* light from a distance of 12 miles, the *white* light from a distance of 16 miles. The lighthouse, 38 feet high, is a circular stone tower, painted *yellow*.

The leading light, which kept in line with the above mentioned light bearing S.S.E., leads close to the outer buoy of the Stortemelk, is a *fixed white* light, visible from the bearing S.E. by S. to S. by W. $\frac{1}{2}$ W. (greatest intensity when bearing S.S.E.), elevated 68 feet above the sea, and should be seen in clear weather from a distance of about 9 miles. The lighthouse, 30 feet high, is a small, square, gray dwelling, situated 984 yards N.N.W. from the principal lighthouse.

A *fixed white* light is shown from a *grey* building on East sandhill (Witte lid) visible from S.W. by S., through west, to N.W.

Lifeboats.--There are two lifeboat stations on Vlieland, the one on the north-east end of the island having also a rocket apparatus.

Telegraph.--A telegraph station, connected with Harlingen by a cable, is established on Vlieland island for the use of vessels entering or leaving the Zuider zee.

A cable is also laid from the north-east shore of Vlieland across the inner bar of the fairway of Stortemelk to West Terschelling.

TERSCHELLING ISLAND, including the Bosch, which is only 2 miles from Ameland island, is 14 miles long, East and West, and $2\frac{1}{2}$ miles broad. It is rather higher than the islands hitherto noticed, and many of its duins are composed of bare white sand. There are several beacons on its sand-hills near Brandaris tower for leading into Vlie stroom; there are also two Noords Vaarder beacons, on the sandy tongue projecting westward from the island, which is working outwards, and two others on the south-east end of the Bosch. Terschelling has three villages, West Terschelling, Midsland, and Hoorn; the spire of Midsland is a prominent object near the middle of the island.

The Noords Vaarder beacons lie nearly N.E. and S.W. and are 750 yards apart; the northernmost, which is the smaller, has a square head, and the southernmost a round one.

A beacon stands on the north-west side of Terschelling island, it is 33 feet in height, with a *black* top, $6\frac{1}{2}$ feet square, and 65 feet above the sea.

Terschelling bank light-vessel.--The light is a *flashing white* light, showing *twelve flashes every minute*, or *one flash every five seconds*, elevated 36 feet above the sea (31 feet in bad weather), and should be visible in clear weather from a distance of 11 miles. A riding light is also shown.

The light-vessel, in lat. $53^{\circ} 26' 55''$ N., long. $4^{\circ} 51'$ E., with Terschelling lighthouse S.E. $\frac{3}{4}$ E., distant 14 miles, is painted *red* with broad *white* streak, and having *Terschellinger bank* in *black* letters on the sides, is moored in 15 fathoms. The light is on the mainmast; by day a *black* ball is carried at the mast head; the vessel has a jigger mast.

In order to mark this position, two *watch* buoys, painted *red* with *white* band, and the letters (black) T. S. No. 1 and 2 on them respectively, are placed—No. 1 to the north-west distant 2 cables; No. 2 to the south-west distant 2 cables from the moorings of the light-vessel.

NOTE.—When from any cause, the *flashing* light cannot be exhibited, a *fixed white* lantern light will be shown from the mast head, and a *white* flare every ten minutes from above the gunwale. When the light-vessel is not in station, the usual lights will not be exhibited, but a *fixed red* light will be shown at each end of the vessel. By day, a *red* flag will be hoisted above the *black* ball at the masthead.

Should a vessel be seen standing into danger, a gun will be fired, and repeated if necessary; also, the two signal flags J. D. of the International code "*You are standing into danger*" will be hoisted and kept flying until answered. A bright rocket immediately after a gun will denote the need of assistance from the shore.

Fog signal.—At Terschelling bank light-vessel a siren gives a blast of *five seconds* duration *every two minutes*; a bell will be struck *once every five seconds* should the siren be out of order.

Tidal streams.—The direction and rate of the tidal streams at Terschelling light-vessel is as follows:—

TIDES AT DOVER.					TIDES AT TERSCHELLING BANK		
					LIGHT-VESSEL.		
5 hrs. before H.W.	...	...	...	...	E.N.E.	$1\frac{1}{4}$ to 2	knots.
4 " "	...	...	...	...	E.N.E.	$1\frac{1}{2}$ to 2	"
3 " "	...	...	...	...	E.N.E.	$1\frac{1}{4}$ to 2	"
2 " "	...	...	...	...	East	$\frac{3}{4}$ to $1\frac{1}{4}$	"
1 " "	Slack turning from East to South	0	to	$\frac{1}{4}$			"
High water	...	...	...	...	S.W. $\frac{1}{2}$ W.	$\frac{3}{4}$ to $1\frac{1}{4}$	"
1 hr. after H.W.	...	...	...	...	W.S.W.	1 to $1\frac{1}{2}$	"
2 " "	...	...	...	...	W.S.W.	1 to $1\frac{1}{2}$	"
3 " "	...	...	...	...	W.S.W.	$\frac{3}{4}$ to $1\frac{1}{2}$	"
4 " "	...	...	...	...	West	$\frac{1}{2}$ to 1	"
5 " "	Slack turning from West to N.E.	0	to	$\frac{1}{4}$			"
6 " "	...	...	...	...	N.E.	1 to $1\frac{1}{2}$	"

Terschelling light is upon Brandaris tower, a tall square structure with a flat roof, near West Terschelling, and one of the most distinct objects on the whole coast. It is shown, at 177 feet above high water, as a *fixed white* light, and in clear weather it may be seen from a distance of 20 miles in every direction.

A **leading light** is exhibited from a wooden support 17 feet high, on the south-west coast of Terschelling island, 320 yards N.W. $\frac{1}{2}$ W. from Brandaris light; and which lights kept in line lead through the new channel, named Thomas Smit gat, from the outer red buoy into Noord Oost gat. It is a *fixed white* light, visible from the bearing N.E. by N., through east and south, to S.W. It is elevated 94 feet above the sea, and should be seen in clear weather from a distance of 12 miles.

West Terschelling light is *fixed white* and visible round the horizon for a distance of 4 miles, it is placed on the east end of West harbour mole.

Another *fixed white* light visible 11 miles is shown from a mast above a *yellow* shed at $1\frac{1}{10}$ miles N.E. by E. $\frac{1}{2}$ E. from the above, and in line with it, lead into Schuitengat.

Harlingen.—A *fixed white* light is exhibited at 56 feet above the sea, from a tower near the church; the light can be seen at a distance of 13 miles. There is a *fixed white* light on the North mole, visible 11 miles.

The above two lights in line lead up to the entrance of the haven, through the channel dredged in the "Pollen," between the beacons on the current guiding dam on the south, and the *black* buoys to the north. The least depth at low water in the channel is $7\frac{1}{4}$ feet.

A *fixed red* light is shown on the head of the North mole, and a *fixed green* light on the South mole head, visible one mile.

Buoys.—The Noorder and Wester grondens are marked by three buoys, which are all liable to be shifted as the channels change.*

Wester gronden buoy is a *black* and *white* horizontally striped buoy with a staff and two *black* balls on it. The buoy lies in $9\frac{2}{3}$ fathoms, 6 miles S.S.E. $\frac{3}{4}$ E. from Terschelling bank light-vessel, and nearly 5 miles off Vlieland.

Noord-west gronden buoy is *red* with staff and diamond, and lies in $12\frac{1}{3}$ fathoms water, $7\frac{1}{4}$ miles S.E. $\frac{3}{4}$ E. from the light-vessel.

Noorder gronden buoy is a *red* and *white* horizontally striped buoy, with a staff and two *red* balls one above the other. The buoy lies in $12\frac{1}{2}$ fathoms, 10 miles E. by S. $\frac{1}{2}$ S. from the light-vessel.

* See page 17 for future buoyage.

These outer buoys are liable to break adrift during stormy weather.

VLIE STROOM, the passage between Vlieland and Terschelling, is used both by vessels seeking shelter, and also by those from the north-eastward bound to Amsterdam, to Harlingen and the harbours in the Zuider zee. The channels are liable to change, necessitating alteration in the buoyage, and are named Stortemelk, Noord west gat, Noord oost gat, and Thomas Smit gat.

Those approaching from the north-west, should keep within the eastern limit of the *red* light shown from the principal lighthouse on Vlieland, in order to avoid Wester Gronden.

Navigable depths to Harlingen.—In June, 1892, the least depth in Noord oost (N.E.) gat was $9\frac{3}{4}$ feet; in Stortemelk $17\frac{3}{4}$ feet, with a rise of $5\frac{1}{4}$ feet; Thomas Smit gat $17\frac{3}{4}$ feet. A vessel of $14\frac{1}{2}$ feet draught can navigate the channel from sea to Harlingen at high water neaps, and of $10\frac{1}{2}$ feet draught at low water springs. The heaviest draught vessel that has visited the port was of 17 feet draught, but was compelled to lighten before entering the harbour.

Pilots for Vlie stroom are always to be obtained. Their vessels carry the name *Terschelling* on the main-sail, and also a blue flag and number.

A bell beacon vessel lies in Vlie stroom near the entrance of the Schuitengat in 4 fathoms.

Stortemelk, this entrance into Vlie stroom, is between Wester gronden and the flat shore of Vlieland. It is marked at its entrance by buoy painted *red* and *black* vertically, surmounted by a cross. *Black* buoys on the north side of the channel, and *white* buoys to the southward. The channel is liable to change, and the buoys are shifted as required.*

Noord west gat is between Noorder gronden and Wester gronden, the entrance is over a bar which connects the two grondens, and is not buoyed.

Noord Oost (N.E.) gat, between Terschelling bank and Noords vaarder on the east, and Noorder gronden and Wester gronden on the west, is principally used by vessels from the north-eastward. The fairway of its entrance is marked by a *red* and *white* vertically striped nun buoy with a staff and *red* ball. The passage is then marked by *black* buoys, to the south-eastward, and *white* buoys to the westward along Noorder and Wester grondens.*

* See page 17 for future buoyage.

The same arrangement of buoys marks the channels in the various directions branching from the junction of those described to Vlie road, West Terschelling, Harlingen, and the ports in the Zuider zee. The positions of the buoys are altered according to changes in the channels.

Thomas Smit gat, with a depth of $17\frac{3}{4}$ feet (June 1892), is a new channel from the outer *red* buoy of the Noorder grondon into Noord Oost gat, and is about 3 miles wide. It is marked by *white* conical buoys on the starboard hand when entering from seaward, and by *black* can buoys on the port hand. The leading lights are in line bearing S.E. $\frac{1}{2}$ E.*

Lifeboats.—There is a lifeboat station near Terschelling lighthouse, a second about the centre of the island, and a third at the east end.

Directions.—The Stortemelk is so liable to change that it is not prudent to give particular leading marks for making the entrance. After passing between the buoys the lead must be the best guide.

Tidal streams in Vlie stroom.—It is high water, at full and change, at West Terschelling at 8h. 40m., springs rise 6 feet; and at Harlingen at 9h. 0m., springs rise $5\frac{1}{2}$ feet.

The flood stream for the first 4 hours runs across the channel of of Noord oost gat, and for only 2 hours through it, whereas in the Noord west gat both streams set fairly through.

HARLINGEN is connected by rail and canal with Leeuwarden, 16 miles distant. The town has regular steam communication with Amsterdam, and carries on a trade with Great Britain, Norway, and the Baltic. There are four slips for small vessels and two pontoons respectively for vessels of 300 and 700 tons.

Coal is usually to be had.

AMELAND, the island next eastward of Terschelling, lies at an average distance of 6 miles from the main. It is 12 miles long E. by S. $\frac{1}{2}$ S. and W. by N. $\frac{1}{2}$ N., and 2 miles wide, and has three villages on it, Nes, Ballum, and Hollum; the church of the latter place, near the west end of the island, with several windmills and beacons, are the most prominent objects. The island is generally flat, and occasionally suffers from inundations; its pastures feed cattle which are reared for exportation, but the principal dependence of its population is upon fishing and seafaring.

LIGHTS.—From a lighthouse coloured *brown*, with a *white* band, situated on the north-west sand-hill of Ameland island, a

* See page 17 for future buoyage.

group flashing light shows *three white flashes* in quick succession, as follows :—A flash of 2 *seconds*, eclipse 3 *seconds*, flash 2 *seconds*, eclipse 3 *seconds*, flash 2 *seconds*, followed by an eclipse of 18 *seconds*. The light is 187 feet above high water, and should be visible in clear weather for a distance of 20 miles.

Hollum light, 477 yards N.W. by W. from the above, shows *fixed white* between N. by W. and W. by S., visible 12 miles, obscured over Ameland.

Ameland gat, between Ameland and a sandy track named the Bosch, extending from Terschelling, has two entrances, Middle gat, (Akkepolle gat) and West gat. A third entrance, East gat, has of late years become sanded up, and the buoys are removed, except the outer buoy, which is *red*, with staff and ball.*

Caution as to buoys.—It is to be remarked that the order of the buoys as to colour, which usually prevails on the Netherlands coast, is in and eastward of Ameland gat, reversed; *black* buoys lying to the westward, and *white* buoys to the eastward. The positions of the buoys are changed as the gateways alter.*

Beacons.—On the south-east end of the Bosch are two beacons for guiding vessels into Ameland gat; they are about one-third of a mile from each other.

Middle gat or Akkepolle gat.—The Fairway buoy (Bornrif) is *red* and *white* chequered, and is surmounted with a staff and triangle. The *black* buoys must be left on the starboard hand, and the *white* buoys on the port and through the fairway to as far as the Bosch beacons.*

West gat is now buoyed; *black* buoys on the starboard side, *white* on the port when entering, the outer or fairway buoy is moored in 6 fathoms, and is a *red* nun buoy with *white* band, and staff and *black* ball; these buoys are moved as the channels change.*

NOTE.—As both these entrances are constantly liable to change, and have not more than 9 to 12 feet depth at low water, they are only fit for small craft, and a further description would be more likely to mislead than otherwise. A customs vessel lies 4 miles up on the east side.

Pinke gat is a small and intricate passage round the east end of Ameland; it is marked by *black* buoys.*†

* See page 17 for future buoyage.

† See Admiralty chart :—Ameland to Jade river, including the river Ems. No. 2,593; scale, $m = 0.5$ of an inch

Lifeboats.—There are two lifeboat stations on Ameland island, one at Nes, the other at Hollum lighthouse.

SCHIERMONNIKOOG, the easternmost of the islands off the coast of Friesland, and lying 5 miles outside the mouth of Lauwer zee, is nearly 7 miles long and $1\frac{1}{2}$ miles wide; the eastern portion of the island is a bare sand-hill, but the other parts afford some good pasturage. On the west end of the island is the little village Schiermonnikoog (Oosterburen), with a church and mill.

LIGHTS.—The two lighthouses on the sand-hills near the western end of Schiermonnikoog island, are circular *red* towers, which serve as good distinguishing marks, and exhibit *fixed* white lights. They stand 1,102 yards S.E. by S. and N.W. by N. from each other, and are apparently of nearly equal height when viewed from the offing.

The lights are respectively 147 and 139 feet above high water, and are visible in clear weather at a distance of 18 miles.

The North light is visible seaward between the bearings E. by S. $\frac{1}{2}$ S., and S.W. by W. $\frac{1}{2}$ W.; the South light between N. $\frac{1}{2}$ W., through north, east, and south, to S.W. by W. $\frac{1}{2}$ W.; the North light when seen should clear the banks off the mouth of the Western Ems; the south limit of the North light, the dry sands off Ameland; and the South light shows up Friesche gat.

There is a telegraph and signal station.

Lifeboat.—There is a lifeboat station near Schiermonnikoog village.

FRIESCHE GAT, the channel leading towards Lauwer zee and Groningen, is between the sands extending from Schiermonnikoog and Englishman's flat, and adjoining sands to the eastward of Ameland. There are three passages over the banks which are always working eastward, the North-west gat becoming the North gat which in turn becomes the North-east gat, the old North-east gat disappearing on the Kuipersbult or against Schiermonnikoog. While these gats are working eastward a new North-west or Plaat gat is forming on the north side of Englishman's flat, between it and the buoys on the west side of North-west gat. From the constant changes occurring in these channels a stranger should not attempt them without a pilot. In June 1892, the depths in North-west gat was 13 feet, in North-east gat 9 feet.

The **Bosch plaat**, and the several channels running into Groninger Wad, are between Schiermonnikoog and Rottum.

A beacon, 62 feet high, surmounted by a ball stand on the northern part of Bosch plaat.

Tides.—It is high water, full and change, at Ameland at 9h. 30m.; springs rise $6\frac{1}{4}$ feet, and at Schiermonnikoog at 9h. 40m.; springs rise $5\frac{3}{4}$ feet.

ROTTUM ISLAND, 8 miles east of Schiermonnikoog, is 3 miles long E.S.E. and W.N.W., and lies at the western entrance of Ems river; its eastern end is 3 miles S.W. from the western-end of Borkum island, and is gradually wearing away.

On the north sand duin of Rottum island there is an iron beacon, 72 feet high, and on the south-east duin is another iron beacon, 82 feet high. Each beacon is surmounted with a frame or screen. See sketch of beacons on chart No. 2,593. The beacons bear from each other S.S.E. $\frac{1}{2}$ E. and N.N.W. $\frac{1}{2}$ W., distant 793 yards apart.

Boundary.—The boundary between the Netherlands and Germany traverses the Western Ems, from the head of the Dollert. Borkum island is in German waters; and Rottum in that of the Netherlands.

BORKUM ISLAND is between the two outlets of the river Ems, named the Western and Eastern Ems. The island is about 5 miles long and 2 broad, and 14 miles in circumference, with sand-hills at each end. At high water, the sea almost flows through a hollow, and divides it into two nearly equal parts. The inhabitants reside in a village at the west end. Most of the men are seamen, and the remainder support themselves by husbandry and the rearing of cattle.

Borkum island is connected with an extensive series of sands, having a general N.W. and S.E. direction; those landward are termed the Randsel, and those seaward Borkum reef.

LIGHTS.—Borkum island lighthouse, 197 feet high, is at Westland at the western end of the island. The light is a *fixed and flashing* light, showing as follows:—*Fixed* 60 seconds, *eclipse* 23 seconds, *flash* 10 seconds, *eclipse* 23 seconds; it is elevated 207 feet above high water, and should be visible in clear weather from a distance of 21 miles. At the distance of from 14 to 16 miles a faint continuous light is seen. An auxiliary *fixed red* and *white* light is shown below the above, visible 7 miles; shows *red* between E. by N. and E. by S.; and *white* between E. by S. and E. by S. $\frac{1}{4}$ S.

For the Ems river lights, see page 172.

Borkum leading light, situated near the lifeboat shed, is a *fixed and flashing white electric* light, elevated 105 feet above the water, and should be visible in clear weather from a distance of 16 miles.

This light is so arranged as to show sectors of *fixed white* light over the channels, but owing to the complicated character of the details of the sectors, and the changeable nature of the channels, details are not placed upon the Admiralty Chart.

NOTE.—The principal details of this light are given in the Admiralty List of Lights, Part II., published annually.

Beacons.—Near the church at the west end are two brick beacons, which at a distance resemble gothic arches, the East Ems, 75 feet high or 109 feet above high water, having a triangular head. The Riff gat or New beacon, 39 feet high or 68 feet above high water, with a square head. There is also a brick beacon named East-land, 24 feet high or 51 feet above high water, and having a triangular top, upon the eastern extremity of the island. *See* sketch on chart, No. 2,593.

Storm signals are shown from the signal staff at the western end of Borkum island, *see* page 9. Vessels can communicate with the signal and telegraph station by the International code.

Lifeboats.—There is a lifeboat on the south-west and also the north-west sides of Borkum island.

BORKUM FLAT stretches fully 27 miles North and N. by E. from Borkum island, and is commonly sounded upon by those bound to the Weser or Elbe, for the purpose of checking their distance. The bottom is principally coarse white sand, with small yellow or red stones, sometimes with black or white gravel, and occasionally with red or white shells. The depths upon the flat vary between 11 and 17 fathoms, and are less by one to $1\frac{1}{2}$ fathoms than the depths on either side; this fact, taken in connection with the quality of the bottom, renders it extremely useful for the purpose above stated. The light-vessel now serves as an excellent guide for vessels.

Light-vessel.—Borkum flat light-vessel is moored in 14 fathoms, with Borkum lighthouse bearing S.S.E. $\frac{1}{2}$ E. distant 19 miles. The vessel exhibits three *fixed* lights, on separate masts, viz.: a *red* light on the main-mast, and a *white* light on the fore and mizen-masts; the *red* light at an elevation of 46 feet, and the *white* at 36 feet above the sea, and in clear weather visible from a distance of 8 miles. A riding light is carried on the fore-stay about 5 feet above the rail.

By day the vessel has a *black* globe on the fore and mizen-masts, and a pyramidal basket cage on the main-mast.

When a vessel is seen steering a wrong course, two guns will be fired in quick succession, and the danger signal of the International

code hoisted. When the vessel, which occasionally drifts, is not in station, neither the day-marks nor the lights will be exhibited.

Fog signal.—A horn gives a blast of *five seconds* duration *every minute*.

Directions.—Borkum flat is about 57 miles from Heligoland ; during northerly winds and thick weather a vessel should pass outside the flat, and when the estimated distance from the island is about 24 miles with a depth of 17 or 18 fathoms, soft muddy ground it will be well to heave to, as it often occurs that the vessel is eastward of the reckoning.

It is essentially requisite that before closing the Elbe a sight of Heligoland, or soundings off the coast, should be obtained, for there is soft ground both in the parallel of and 18 or 21 miles northward of Heligoland ; and in many instances seamen, from not observing the precaution here recommended, and supposing themselves to be off the coast in 18 or 19 fathoms, have stood S.S.E., got into 14 and 15 fathoms, coarse sand and small stones, leading them to imagine themselves on Borkum flat, and have eventually found themselves several miles northward of Heligoland.

EMS RIVER rises 28 miles south-west from Minden ; it then flows S.W. and N.W. through Westphalia ; traverses the western section of the former kingdom of Hanover, to the wide expanse named the Dollert, near the town Emden, 30 miles below which, after a westerly and north-westerly course, it joins the sea by the Western and Eastern Ems. For the last 15 miles of its course the Ems has a wide estuary, which is principally occupied by Borkum island and the sands connected with it.*

All the ports in the Ems estuary are tidal, and vessels generally ground at low water alongside the wharves.

Caution.—The changes in the channels, sands, and buoyage are so frequent, that no stranger should attempt to enter without a pilot. The buoyage system is that uniformly in use in German waters. See page 18.

Navigable depths.—In 1891, the least depth in Huibert gat was 31 feet ; in Riff gat 28 feet. On the outer bar of Western Ems 28 feet ; on the inner bar 22 feet. On the bar of Randsel gat 23½ feet.

A vessel of 16 feet draught can navigate the channel from sea to Emden at high water neaps, and of 8½ feet draught at low water

* See Admiralty chart :—Ameland to Jade river, including Ems river, No. 2,593.

springs. The heaviest draught vessel that has visited Emden port was of 13 feet draught.

Pilots.—The Dutch pilot cutters of the river, have the names *Ems* and *Delfzijl* on the mainsail.

Ice.—The frost seldom begins before the middle of December and lasts sometimes till March. The time of closing and opening the navigation of the river depends upon the weather. The ice first appears on the lee side, then on the opposite and lastly in mid-channel. The strongest ice drift is from inner Emshorn buoy, eastward of Emshorn to the Outer Emshorn and then in a W.N.W. direction as far as the Outer Wad buoy.

In 1888-89 navigation of the Ems was interrupted by ice on 12th November. On 18th January the river was full of drift ice. On 14th February the ice was packed for the fourth time that winter. On 5th March there was still much ice in the river.

RIVER LIGHTS.—**Fischer balje** or **Visschersbalg** is a *fixed* light, with *red* and *white* sectors, shown from a beacon 46 feet above high water, on the eastern side of Visschersbalg, at the south side of Borkum island; it shows *red* between N. 44° W. through north and east, and S. 44° E.; *white* between S. 36° E. and S. 34° E.; and *white* between S. 14° E. and S. 64° W., visible 6 miles; in any other direction than the above, the light is obscured.

Randsel bank light is a *fixed* light with *red* and *white* sectors shown from a beacon 46 feet above high water, on the southern part of Randsel bank. It is *red* between N. 53° W. and N. 26° W.; *white* between N. 26° W. through north to N. 60° E.; *red* between N. 60° E. through east to S. 41° E.; and *white* between S. 41° E. and S. 36° E.; on other bearings it is obscured. Visschersbalg and Borkum lights in line, N. 30° W., leads through the south-east part of Randsel gat.

Pilsum, on the east side of Ems river entrance, is a *fixed* and *flashing white* light. It is elevated 49 feet above high water, and should be visible in clear weather from a distance of 12 miles.

Campen.—The leading light near Campen is a *fixed and flashing white electric* light, elevated 203 feet above high water, and should be visible in clear weather from a distance of 21 miles.

The light support, 214 feet high, is an iron cylinder, painted *white*, with *red* lantern, supported by a *red* iron tripod.

Watum.—The leading light near Watum is a *fixed and flashing white and red* light, elevated 39 feet above high water, and should be visible in clear weather from a distance of 11 miles.

The light is shown from a stone dwelling.

Delfzijl light is a *fixed* and *flashing red* and *white* light. It is elevated 52 feet above high water, and should be visible in clear weather from a distance of about 13 miles.

At **Delfzijl** there is a small *fixed red* light at the north entrance to the port, visible 3 miles, off which is good anchorage. There are also two *fixed* lights *red* and *green* at the inner harbour.

NOTE.—The above mentioned lights, and other lights, in Ems river, at and below **Delfzijl**, are so arranged as to show, as a general rule, sectors of *fixed white* light over the channels, but owing to the complicated character of the details of the sectors, and the changeable nature of the channels, details are not placed upon the Admiralty chart. The principal details are given in the Admiralty List of Lights, Part II.

At **Knock**, 4 miles across the river from **Delfzijl**, and where it turns sharp round to the eastward for **Emden**, at 5 miles below the city, is a *fixed* light on the dyke, elevated on a red tower 29 feet above high water; it should be seen 6 miles between the bearings S. 14° E., through an arc of 240°, and N. 74° W.

Termunterzijl light on the opposite side of the river to **Knock**, is a *fixed white* light at the entrance of the port.

Tides.—It is high water, full and change, at **Rottum** 10h. 0m., at **Borkum** 10h. 30m., at **Emden** at 0h. 34m., and the average spring rise is from 7½ feet at **Rottum** to 9 feet at **Emden**.

WESTERN EMS begins at the upper part of the **Randsel**, and has a general N.W. $\frac{1}{2}$ N. direction between the islands **Borkum** and **Rottum**, to its junction with the sea.*

The Western Ems, which is wider and more direct than the Eastern Ems, is between **Borkum** reef and the **Randsel** to the north-east, and **Huibert** flat (abreast **Rottum**), **Horsborn** sand, and **Uithuizer** wad to the south-westward. Middle grounds divide the entrance into three channels the northern of which is the **Riff** gat; and the southern **Huibert** gat.

Navigable depths, see page 171.

Caution.—Mariners are cautioned that the sand-banks at the mouths of the Ems are frequently shifting, and that during the winter months the river is liable to silt up; the channels alter, and require re-marking in the spring.

In consequence, detailed directions are not given as they are likely to mislead. A pilot should be employed by strangers.

* See Admiralty chart :—Ameland to Jade river, including Ems river, No. 2,593.

Buoys.—The buoyage of the channel of the Ems is in accordance with the German uniform system. *See* page 18. Off the entrance of the Western Ems is placed a *black* beacon buoy, with "*Western Ems*" on it, and surmounted by a staff and flag; the buoy lies in about 8 fathoms, with the outer beacons on Rottum island bearing S.E. by S.; the outer buoy of Huibert gat is a *red* and *black* beacon buoy, surmounted by a cross.

An automatic whistle buoy painted *black* and *red*, with *Riff Gat* on it, is moored at the entrance of Riff gat in 8 fathoms water, with Borkum lighthouse, bearing S.E. $\frac{1}{4}$ E.

Riff gat.—During the last few years frequent changes have taken place in Riff gat, owing to the extension of Geldzak flat towards the north-east; with strong winds from north to west there is surf in the channel. For vessels of deep draught this passage may prove dangerous. Strangers should not use this channel, especially in bad weather.

Anchorage.—There is secure anchorage about 2 miles above Horsborn sand anywhere abreast Meeuwer Staart, rather over towards the edge of Uithuizer wad, in from 11 to 9 fathoms at low water, good holding ground.

The junction of the Western with the Eastern Ems is 4 miles above this anchorage.

EASTERN EMS is formed between Juist reef, Cachelot flat, Memmert isle, Koper, and Schuiten sands to the north-eastward, and Brouwer flat (the eastern portion of Borkum reef) and the Randsel to the south-westward. The sides of this channel are broken, and its width is irregular: the general course through it, first S.E. by E., changes at the upper part to S. by W. It joins the Western Ems at the inner part of the Randsel; and is buoyed in accordance with the German system, *see* page 18.

Caution.—A pilot should be taken by strangers bound for the Ems, for the channels are changeable, intricate, and the tidal streams rapid.

A beacon, 49 feet high, with a ball on the top, stands on the highest part of Memmert isle.

Buoy.—The outer buoy of the Eastern Ems is a *red* and *black* beacon buoy with *Osterems* on it.

Submarine telegraph cable.—The telegraph cable in the Eastern Ems, from Borkum to Memmert is marked by *green* spherical buoys, each with the word *Telegraph* on it in *white* letters.

DELFIJL is a Netherlands port of growing importance, situated on the western shore of Ems river, 19 miles above Borkum. The principal trade is in timber from the Baltic, also from America, conducted during the months April to November. It is a pilot station. The harbour is of moderate extent, but affords security to shipping. It is connected by railway and canal with Groningen.

The outer harbour, 2600 feet long by 500 feet wide, is tidal, but is connected with an inner harbour by a lock 196 feet long, $3\frac{1}{4}$ feet wide, and 17 feet on the sill at high water. There are slips and the pontoon that can take vessels of 800 tons.

Navigable depths.—The depth in the harbour and the fairway to it is $12\frac{1}{2}$ feet at low water, which depth it is necessary to maintain by dredging.

Buoys.—During summer the entrance is marked by two spherical *red* buoys on the southern side. In winter, the north side of the entrance is marked by two small beacons with brooms, and the south side by two small stake beacons.

Supplies.—Provisions, water, coal, and other requirements of vessels can be obtained ; and repairs can be executed.

Tides.—It is high water, full and change, at Delfzijl at 11h. 15m.; springs rise 10 feet.

EMDEN carries on a considerable trade, especially in oats. It is connected with Hanover by a railway. A submarine telegraph connects Emden and Borkum, and Lowestoft.

The harbour at Emden in connection with the canal has been considerably improved by the construction of a dock, the lock into which is 328 feet long and $49\frac{1}{4}$ feet wide, and having $21\frac{1}{2}$ feet over the sill at high water.

The **Ems Jade canal** is intended for both commercial and military purposes. The canal connects Emden with Wilhelmshaven.

The locks will admit vessels of 100 feet in length, 20 feet in breadth, and drawing not more than 6 feet. The depth of water in the canal is about $6\frac{1}{2}$ feet. Mooring berths and turning places, as well as canal harbours, have been constructed at different places along the canal.

Storm signals are shown by day and night at the above mentioned lock. *See* page 9.

ASPECT of the COAST.—The East Frisian islands comprise the low sandy islands Juist, Norderney, Baltrum, Langeroog,

Spiekeroog, and Wangeroog, lie at the average distance of 4 mile from the coast of Harlingerland, and extend as a continuous chain in an E. by S. direction for the whole distance between the Eastern Ems and the mouth of the Jade. The spire of Esens church, 194 feet high, is a remarkable object, it can be seen over Langeroog.

See sketches of the principal landmarks, on chart No. 2,593.

The channels dividing these islands from each other and the shore, afford to the small craft of the country the means of communication between the Ems and the Jade and Weser, to which description of vessels only they are available ; most of them have beacon buoys marking the entrance.

Juist, the first island eastward of the Ems, is about 8 miles in length, and a half a mile wide, and on it are two small villages ; one mile south-west of its west end is the sandy isle Memmert.

There are two lifeboat stations on Juist.

Norderney, the next, is about 7 miles long, with three conspicuous white sand-hills on the eastern part, and a village at the west end, where there are two remarkable buildings, each having a small steeple ; the church is 65 feet high, but without turret or steeple. At the west end of the island on a hill, is a beacon, in the form of a portico, 36 feet high, surmounted by a triangle with the apex downwards, and 134 feet above the sea ; close westward of it is a square tower 45 feet high, and south of it is a mill. A telegraph cable connects Norderney with Juist and the continent.

LIGHT.—An octagonal *red* lighthouse 175 feet in height, stands near the centre of Norderney, a *flushing white* light is exhibited from it, at intervals of *ten seconds*, at an elevation of 195 feet above high water, visible 20 miles. There is a telegraph and signal station at the lighthouse.

The whistle buoy off the entrance to Norderney gat, is coloured *black* and *red*, with the name *Norderney* on it, and is moored in $6\frac{1}{2}$ fathoms, with Norderney lighthouse bearing S.E. by S., distant $4\frac{1}{2}$ miles.

Storm signals are shown from a signal staff at the north-west end of Norderney. *See page 9.*

Baltrum island is about 3 miles in length, and lies next eastward of Norderney ; on it are two clusters of houses.

There is a lifeboat station on the northern side

Langeroog is composed of three portions, Westerende, Melk Horn, and Oosterende, and is about 6 miles in extent. The chief village is on the west end, near to which on the rise are two beacons, that to the north-east is in the form of a pyramid 46 feet high, that to the south-west is likewise 46 feet high, it is also a pyramid, they are surmounted by triangles, the north-east with its apex upwards, and the south-west with it downwards; the first beacon is 96 feet above the sea and the other 125 feet.

There are lifeboat stations on the east and west ends of Langeroog.

Spiekeroog is $3\frac{1}{2}$ miles long, with sand-hills to the westward, behind which is the village. There is a lifeboat station.

The passage between Spiekeroog and Wangeroog is named the Harle, the outer buoy is *red* with a staff and ball.

Buoys.—The leading buoy off the entrance of Akkumer Ee (Accumer Ee) is a *red* beacon buoy with *Akkum* on it, and surmounted by a ball. The leading buoy off the entrance of Otzumer Balje is a *black* beacon buoy with *W. Otzum* on it, and surmounted by a ball.

WANGEROOG.—The mouths of the Jade and Weser are bounded to the westward by Wangeroog, a low sandy island, about $2\frac{1}{4}$ miles long E.S.E. and W.N.W. and half a mile broad.

A village formerly stood upon the west extremity of the island, and the tower of its church 177 feet above high water, still standing in the sea at high water, is one of the most prominent objects upon the coast, but the village has gone.*

The tower is quadangular, of bright red stone, with three turrets and a slate roof.

There is a telegraph cable laid from Wangeroog to Carolinen siel on the mainland opposite, which is in connection with the Continent and England. A signal staff in connection with the telegraph station communicates with shipping by the International code.

Ice signals.—Signals are hoisted from the signal station on Wangeroog, signifying the condition of the ice in the river Jade.

* See Admiralty chart of the Elbe river, &c., No. 1,875, scale, $m = 0.5$ of an inch.

The signals are made with a ball, a drum, and a cone, and can be seen from between the bearing of S.S.E. round by south to S.W.

A ball	-	-	-	-	ice moving everywhere ;	{ the entrance of the port is impracticable.
A drum	-	-	-	-	do.	{ the entrance of the port is practicable, but the lock gates impracticable.
A cone with the point up	-	-	-	-	do.	{ the entrance to the port and lock gates practicable.
A ball over a drum	-	-	-	-	ice moving in the river ;	{ the entrance of the port impracticable.
A ball over a cone with the point up	-	-	-	-	do.	{ the entrance of the port is practicable, but the lock gates impracticable.
A drum over a ball	-	-	-	-	do.	{ the entrance of the port and lock gates practicable.
A drum over a cone with the point up, a little ice in the river ;	-	-	-	-		{ the entrance of the port impracticable.
A cone with the point up, above a ball	-	-	-	-	do.	{ the entrance of the port practicable, but the lock gates impracticable.
A cone with the point up, over a drum	-	-	-	-	do.	{ the entrance of the port and lock gates practicable.
A cone point downwards	-	-	-	-	-	No more ice.

Ice signals are also shown from the old church tower on Wangeroog, indicating the condition of the ice in the Weser :—

One black ball	-	-	-	-	Drift ice in the river, though entrance is practicable, with caution.
Two black balls	-	-	-	-	Entrance is dangerous, light-vessel is not in station.

LIGHT.—Wangeroog lighthouse is a *red brick* circular tower 100 feet high, near the north-eastern extremity of the island. The light is *flashing*, showing a bright face once *every minute*, the duration of the light is *twenty seconds* ; it is placed at the height of 100 feet above high water, and is visible 16 miles.

Fog signal.—A siren at 560 yards N.N.W of the lighthouse, gives, every *two minutes*, two blasts of *six seconds* duration each, with silence of *eight seconds* between the blasts.

Beacons.—Dunen beacon 50 feet in height, is on the sand-hill 566 yards N. by E. $\frac{1}{2}$ E. from the lighthouse. Storm signals are shown near this beacon, *see* page 9.

On the sands east of the island are two other beacons, the furthest with a triangular summit and vane on the Minsener Old Oog, lies $4\frac{1}{4}$ miles S.E. by E. $\frac{1}{2}$ E. from the lighthouse; Strand beacon stands about midway between the outer beacon and the island, and is in the form of two cones joined at their points like an hour glass.

Mellum beacon on the west side of Alte Mellum sand is 62 feet high, and built of wood in the shape of a pyramid. The upper part is covered with laths, and forms a small room for shipwrecked people.

Weser light-vessel off the entrance of the Jade and Weser is moored in 12 fathoms, $7\frac{1}{4}$ miles N. $\frac{3}{4}$ W. from Wangeroog light-house.

The vessel has three masts, and is painted *red*, with *Weser* in *white* letters on sides, and carries a *red* cage at each mast head.

A *fixed white* light is exhibited at each masthead, at 39 feet above the sea, visible 10 miles.

A riding light is hoisted on the fore-stay 6 feet above the rail, and when the vessel is out of position, neither the lights nor the cages will be shown, but a *black* flag will be hoisted at the gaff.

When vessels are observed steering a wrong course, a gun will be fired, and signals made in accordance with the International code.

The German pilot-flag will be hoisted at the main when Jade river pilots are on board.

Fog signal.—A fog horn is sounded for a period of *twenty seconds* in *every minute*, the intervals between the signals being *forty seconds*. The fog bell will be struck loudly *five* times at short intervals, in each group of the signals.

JADE RIVER.—Two middle grounds or sands, of which Jade flat is the westernmost, separate the mouth of the Jade from that of the Weser. The south-west side of the channel is formed by the shallow ground projecting from Wangeroog; 6 miles within the entrance the channel turns to the southward, and is then confined between the extensive flats Mellum and Hohe Weg to the eastward, and the flats from the shore of Oldenburg to the westward.

At 25 miles from the sea the shores of the Jade recede and form an extensive circular basin; the source of the river is near Rastedt, 15 miles above it. The whole length of the Jade may be assumed as 50 miles.*

* See Admiralty chart:—Elbe, Weser, and Jade rivers, No. 1,875.

Caution.—The sands in the Jade are constantly changing; the channels are buoyed in accordance with the German uniform system (*see* page 18), and the buoys are shifted as necessary, so that no detailed directions of use to the mariner can be given, and no stranger should enter the river, without a pilot.

Navigable depths to Wilhelmshaven.—The least depth in the fairway to Wilhelmshaven by the Wangeroog channel is (1891) about $4\frac{1}{2}$ fathoms at low water springs, and 6 fathoms at high water springs.

Pilots.—A pilot vessel painted black generally cruises off the entrance of the Jade, and carries at the mainmast the pilot flag by day, and by night a white light at the mast head; no side lights are shown. A single flare is shown every fifteen minutes to distinguish this vessel from the Elbe pilot vessel, which show three flares in quick succession every fifteen minutes. This vessel can also supply pilots for the Weser.

Weser light-vessel is a station for Jade pilots, the German pilot-flag is hoisted at the main when there are any on board.

Lifeboats.—There are lifeboats stationed at Wangeroog, at Horemersiel in the Jade, and at Heppens near Wilhelmshaven.

Ice.—In the Jade the formation and the disappearance of ice is very uncertain. The channel of the Jade never freezes completely over, and there have been years when there was no ice. As a rule, the first appearance of ice is from the end of November to the middle of December, and no ice is expected to be in the river after 1st March. In general it may be said that the ice in the Jade does not necessitate a closing of its navigation for any length of time.

In 1889 *Genius bank* light-vessel left her station on 8th and 30th January, 13th February, and 4th March. The *Aussen Jade* and *Minsener sand* light-vessels were withdrawn on 17th January, and 7th March. The river was clear of ice on 9th March.

Ice signals are shown at Wangeroog signal station, also near Schillighorn lighthouse, *see* page 177.

Buoys.—The entrance of the Jade is marked by an automatic whistling buoy. This buoy, painted *red* with broad *black* band, and the name *Jade* in *white* letters on sides, is moored in 7 fathoms, in line between Weser light-vessel and Wangeroog lighthouse, with the lighthouse distant $3\frac{3}{4}$ miles, vessels may pass on either side of this buoy; also, by *red* spar buoys to the south-west, and *black*

buoys to the north-east, the former being upon the outer edge of the flat from Wangeroog, and the latter upon the south-east edge of Jade flat and on the Minsener sand.

A gas light buoy, showing a *fixed white* light, is moored 2 miles north of Wangeroog strand beacon, it is not exhibited in winter until after the ice breaks up.

RIVER LIGHTS.—Aussen Jade light-vessel near the north-west end of Minsener sand, painted *red*, with three masts, having *Aussen Jade* on sides, is moored in 8 fathoms; carries a *black* ball on the fore and main masts, and the North German pilot flag is hoisted. *Two fixed white* lights are shown, one on the main and the other on the fore mast, at 51 feet and 31 feet respectively above the sea, visible 9 miles; during a heavy sea the lights may be lowered to 41 and 26 feet respectively.

If the vessel is out of position no balls nor lights will be exhibited but a *black* square flag will be hoisted at the main.

Those steering a wrong course will be warned of their danger by the firing of a double discharge every three minutes, sounding the bell, or by signals of the International code, and the proper course will be indicated when possible.

NOTE.—During the winter months, the light-vessels, in consequence of the ice, are liable to break adrift, or be temporarily removed.

Fog signal.—A bell will be sounded for *two minutes*, at intervals of *two minutes*.

Minsener light-vessel lies in 9 fathoms south-eastward of Minsener sand, the vessel is painted *red*, with *Minsener sand* on sides, has three masts, with a ball at the main-mast, and exhibits a *fixed red* light at 51 feet above the sea, visible 7 miles. In foggy weather a bell is sounded for *one minute* at intervals of *two minutes*.

At Schillighorn, eastward of the mole, near the village on the Groden, the north-east point of the mainland on the west side of the entrance of the river, two lights are exhibited from the same tower.

The upper is a *fixed red* light, elevated 69 feet above high water, and is visible between the bearings S. $\frac{3}{4}$ W. and S.W. $\frac{2}{3}$ W. from a distance of 12 miles; and between the bearings S.W. $\frac{2}{3}$ W. and N.N.W. $\frac{3}{4}$ W. from a distance of 9 miles.

The lower is a *fixed white* leading light, elevated 59 feet above high water, and is visible between the bearings N. 25° W. and N. 31° W. from a distance of 11 miles. This light is only visible in

the fairway of the channel, and attains its greatest brilliancy very nearly in the direction of mid-channel.

The light tower, painted *brown*, is an iron column on a stone base. The roof is dome-shaped, surmounted by a ball 76 feet above the ground.

A **telegraph** and signal station, also storm and ice signals, are established at Schillighorn lighthouse (*see* pages 18 and 177). The International code of signals is used.

At Hook siel there is a small *fixed white* light exhibited at 27 feet above the sea from a round stone tower, and may be seen for 6 miles. The light is visible between W. by S. $\frac{1}{2}$ S. and W.N.W. indicating anchorage.

Genius bank light-vessel lies in 29 feet at the south-east extreme of the bank. The vessel is painted *red*, with *Genius bank* on sides; has one mast with a *black* globe on it, and exhibits a *fixed white* light at an elevation of 39 feet, visible for 8 miles.

A fog bell is rung for *two minutes* at intervals of *two minutes*. If the vessel is not in position the light will be extinguished, by day the globe will be lowered and a *black* flag shown.

At Wilhelmshaven a *fixed red* light is shown from the South mole head, is elevated 32 feet above high water, visible 3 miles from the bearing W. $\frac{1}{8}$ N., through north, to East, and is obscured in other directions by the Old mole, the land and buildings.

A *fixed green* light is shown from the bend of the North mole (distant 107 yards from the red light), is elevated 32 feet above high water, and should be seen in clear weather from a distance of 3 miles. The light is visible from the bearing W. $\frac{3}{8}$ N., through north, to East, and is obscured in other directions.

At Vareler siel two lights are exhibited from a light tower erected on Schlaf mole, northward of Varel. The light tower is similar to that at Schillighorn, but is 96 feet high.

The upper light is a *fixed and flashing white* light, elevated 88 feet above high water, in the western sector between the bearings S. 40° E. and S. 12° W., there are *two flashes of one second duration*, each divided by an interval of *one second of darkness*, each pair of flashes being followed by an eclipse of *four seconds*.

A *fixed* light from S. 12° W. to S. 15° W.

In the eastern sector, from S. 15° W. to S. 68° W., are shown *five flashes of one second duration* each, divided by intervals of *one second of darkness*, each group of flashes being followed by an eclipse of *eight seconds*. The light is visible 13 miles.

The lower light is a *fixed white* leading light, elevated 79 feet above high water, visible between the bearings S. 12° W. and S. 15½° W. This light is only shown in thick weather to increase the power of the higher *fixed* light above mentioned, and attains its greatest brilliancy nearly in the direction of mid-channel.

Directions for the Jade.—As before mentioned, in consequence of the frequent changes in the channels, and shifting of the buoys, only general directions can be given; strangers must employ a pilot.

Large vessels enter by Wangeroog channel; from the automatic buoy a S.S.E. course for about one mile will lead up to the channel, having the *red* buoys which are lettered from A on the southern side, and the *black* buoys which are numbered from 1 on the northern, to abreast of Aussen Jade light-vessel; the course will then be gradually more southerly, still keeping between the buoys to the Minsener light-vessel, above which the river widens to about 2 miles in breadth for 5 miles, when the channel, which is buoyed in the same manner, again narrows for about 9 miles to just below Wilhelmshaven.

The flood tide sets over the northern part of the channel in an oblique and easterly direction. Vessels should always pass to the westward of Aussen Jade light-vessel. The Minsener fairway is dangerous at low water to heavy draught ships in consequence of the constant changes.

Anchorage.—From Horemersiel upwards there is good anchorage within the range of Hook Siel light and nearly everywhere, except during gales from the northward.

Tides.—It is high water, full and change, at Wangeroog, at 11h. 37m., springs rise 8¼ feet; at Wilhelmshaven at 0h. 52m., springs rise 11¼ feet.

WILHELMSHAVEN, the principal German naval station on the North sea, is situated on the left bank of Jade river, 23½ miles above the entrance. It is of little commercial importance, and exists for the naval dockyard and arsenal. Vessels can moor in 7 fathoms in the stream. The climate is said to be not very healthy, fever, ague, and rheumatism being the prevailing complaints.

Ems Jade canal, *see* page 175.

Docks.—The Government wet docks can admit vessels of 29 feet draught and 70 feet beam.

The largest graving dock is 440 feet long over all, 84 feet wide at the entrance, and has 29 feet over the sill at high water. Floating sheers lift 50 tons. *See Dock Book.*

Coal.—The usual stock of coal is about 6,000 tons.

Time ball.—On the east tower of the observatory, at 72 feet above high water, and 59 above the ground, a black ball will be hoisted half way up at 10 minutes before noon, and close up at 3 minutes before the signal is made. The ball will drop at noon, Wilhelmshaven mean time, equivalent to 23h. 27m. 24.8s. Greenwich mean time. The ball is again dropped at 0h. 0m. 0s. Greenwich mean time.

Storm signals are shown both day and night. *See page 9.*

Gun practice is frequently carried out from a vessel of war in the Jade, usually northward or westward of Jappen sand above Wilhelmshaven, but sometimes nearer the mouth of the river. The firing-vessel carries a red flag, and any signals from this vessel, or from the shore stations, must be immediately complied with. A black flag is sometimes hoisted at fort Hippens while practice is being carried out.

Torpedo practice is carried out in the summer months, the particular localities being usually notified early in the year. The officials of the torpedo hulks stationed in the Jade warn vessels off the ground, and their orders must be immediately obeyed.

WESER RIVER.—The Weser joins the sea 15 miles westward of the Elbe; it is formed by a junction of the Fulda and Werra, near Münden, on the former frontiers of Hanover and Hesse-Cassel; traverses circuitously, generally towards the north, through small portions of the territories of Hesse-Cassel, Westphalia, and Brunswick; forms the boundary between Hanover and Oldenburg, and has a wide and sand-encumbered estuary. The whole course of the Weser is 250 miles in length; it receives several affluents, and in the lower portion of its course is strongly embanked to protect the country from inundation. The navigation for large vessels ceases at Nordenhaven, on the left bank of the river, 31 miles below Bremen, and 4 miles above Bremerhaven.*

The present channels into the Weser are between Rother sand and Tegeler flats on the north-east, Jade flat, Rother grund, the Mellum

* *See Admiralty chart :—Elbe, Weser, and Jade rivers, No. 1,875.*

flat, Alte Mellum, and Hohe Weg flat to the south-westward; eastward of Rother sand is another channel, the Alte Weser, which joins the principal channel $1\frac{1}{2}$ miles S.E. of Rother sand lighthouse.

Navigable depths to Bremerhaven.—A vessel of 28 feet draught can navigate the channel from sea to Bremerhaven at high water neaps, and of 14 feet draught at low water springs (1890). The heaviest draught vessel that has visited the port was of 28 feet draught. Strong easterly winds decrease the depth to Bremerhaven by 4 feet.

Dredging operations are in progress, which, together with other improvements, will, when completed, admit of ships of $16\frac{1}{2}$ feet draught proceeding to Bremen. This is expected to be completed in 1894.

Caution.—The Weser during the winter months is liable to silt up considerably, causing the channels to alter and require remarking in the spring. The southern channel, the one most generally used, is a comparatively modern one, for the sands at the mouth of the Weser are constantly subject to change. Both channels are buoyed in accordance with the German Uniform system (*see* page 18), but no stranger should enter without a pilot.

Ice.—The ice drift has a powerful influence on the depth of water, especially on the shoals, according to circumstances the ice drift can form a channel or entirely destroy it. The navigation is seldom closed in the harbours Geestemünde and Bremerhaven. Steam vessels, and with their assistance sailing vessels also, are generally able to reach Bremerhaven and Geestemünde during the whole winter, notwithstanding the ice drift.

In 1888–89 the first ice floe appeared in the Weser on 14th November. Navigation to Bremerhaven was closed from 5th to 26th January, and from 12th to 19th February. On 9th March the river was clear.

It is dangerous for a vessel to enter the Weser when there is ice in the river, unless sure of reaching either Fedderwarder or Bremerhaven; Fedderwarder being the more available under such circumstances with westerly winds, and Bremerhaven with easterly winds. When the attempt would be attended with risk, it is better to seek shelter at Heligoland or Cuxhaven.

Ice signals for the Weser are shown from the old church tower of Wangeroog by means of balls on a horizontal pole on the western side 124 feet above the sea. *See* page 178.

Pilots.—There are no pilots for Weser river on board the *Weser* light-vessel. The pilot vessels cruise from Terschelling to the mouth of the Weser: they are fore-and-aft schooners, painted black, without a fore-topmast, and fly the Bremen flag (which is red and white, in horizontal stripes), at the mainmast head.

By night a white light is carried at the masthead; no side lights are shown, but a single flare is made every fifteen minutes.

LIGHTS.—**Weser light-vessel.**—For the description of this vessel and light, *see* page 179.

NOTE.—The light-vessels of the Weser are withdrawn during the breaking up of the winter ice.

Rother sand light.—1. The principal light is visible between the bearings S. $54\frac{1}{4}^{\circ}$ E., through east, and N. $32\frac{1}{4}^{\circ}$ W. It shows a *fixed white* light from S. $61\frac{1}{4}^{\circ}$ E. to S. $68\frac{1}{4}^{\circ}$ E., and from N. $22\frac{1}{4}^{\circ}$ W. to N. $26\frac{1}{4}^{\circ}$ W. Between these two sectors—that is, from S. $68\frac{1}{4}^{\circ}$ E., through east and north, to N. $22\frac{1}{4}^{\circ}$ W., it shows a *flashing white* light, with successive flashes at regular intervals, the flashes and eclipses lasting each about *one and a quarter seconds*; but outside the two sectors of *fixed white* light—from S. $54\frac{1}{4}^{\circ}$ E. to S. $61\frac{1}{4}^{\circ}$ E. and from N. $26\frac{1}{4}^{\circ}$ W. to N. $32\frac{1}{4}^{\circ}$ W.—it shows a *flashing white* light, with *two flashes* in quick succession, followed by an eclipse of about *four seconds*.

This light, intended to guide vessels into the Weser, is 78 feet above high water, and should be visible in clear weather 10 miles.

2. A secondary light in the north-east balcony of the lighthouse shows *fixed white* from S. $11\frac{1}{4}^{\circ}$ E., through south, to S. $54\frac{3}{4}^{\circ}$ W.

This light, intended to guide vessels into the Alte Weser, is elevated 62 feet above high water, and should be visible in clear weather 8 miles.

3. Two direction lights—one in the north-west balcony, the other in the south balcony. The north-west direction light shows a *fixed white* light from S. $54\frac{1}{4}^{\circ}$ E., through east, to S. $89\frac{1}{4}^{\circ}$ E. The southern direction light shows a *fixed white* light from N. $14\frac{1}{4}^{\circ}$ W. to N. $32\frac{1}{4}^{\circ}$ W.

These lights (3), elevated 62 feet above the sea, are not distinctly seen beyond the distance of 2 to $2\frac{1}{2}$ miles; when these lights come in sight they mark the positions in which vessels should steer from one direction light to the other.

The lighthouse, of iron, standing in 23 feet at low water, has three circular balconies below the lantern. The lower part of the light-

house is *black*, the upper part is coloured *white* and *red* in horizontal bands, the balconies are *red*, the lantern *white*, and the roof *black*.

NOTE.—Vessels of heavy draught, when within the *fixed* lights, should not approach the lighthouse nearer than $1\frac{1}{2}$ miles to avoid Rother sand, and which afterwards should not be passed within the distance of at least 5 cables.

When there is much drift ice in the Weser, the signal flags H, Q, R, are shown at the lighthouse.

Fog signal.—A bell is sounded three times at short intervals.

The telegraph cable between Rother sand and Hohe Weg lighthouses, where it crosses the channel from Rother grund to Rother sand lighthouse, is marked by two *green* buoys, with a *white* T.

A telegraph station is established at the lighthouse; messages signalled by the International code can be forwarded. Vessels showing their national flag and distinctive signals, are telegraphed from the lighthouse to Bremerhaven and Bremen.

Bremen light-vessel.—This light-vessel lies in the roadstead within the junction of the two channels, which is generally a position of safety. Moored in 9 fathoms, about 9 miles S.E. $\frac{1}{4}$ E. from the Schlüssel or Key buoys; and $6\frac{1}{2}$ miles N.N.W. from Hohe Weg lighthouse.

This vessel exhibits a *fixed white* light 38 feet above the water, and visible 8 miles in clear weather; has two masts, carries a ball at the head of one of them; is painted *red* with a *white* streak and *Bremen* on sides.

Like the outer light-vessels of the Elbe, this vessel is sometimes forced to sea by the ice in the winter season; when not in position the light is not shown nor the ball hoisted.

Fog signal.—A bell is sounded six times at short intervals.

Hohe Weg lighthouse, on the north-east side of the flat, is an octagonal structure of brick upon a stone basement, 118 feet in height, surrounded by a terrace with an iron railing. It exhibits, at 88 feet above high water, a *fixed white* light, which should be visible in clear weather, at a distance of 16 miles; it may, therefore, be seen from the Schlüssel or Key buoys, and is visible in all directions except between the bearings N.E. $\frac{1}{4}$ E. and E. $\frac{3}{4}$ N. through which portion of arc it is obscured, and indicates the northern and southern limits of Hook siel flat.

A small *fixed white* light from S. by E. $\frac{3}{4}$ E. to W.S.W.; and a *red* ray is shown from the lower part of the lighthouse, at a height of 39 feet above high water; it is visible in clear weather at a distance of 7 miles when bearing about E.N.E.

There is a signal station at Hohe Weg, connected with the telegraph system, vessels communicate by the International code. A message can be sent to Bremerhaven or Fedderwarder siel for a steam tug.

Fog signals.—A bell is sounded twice (double stroke) every minute.

Eversand lights.—Two *black* lighthouses in line, S. $19\frac{1}{2}^{\circ}$ E. or N. $19\frac{1}{2}^{\circ}$ W., indicate the course through Wurster channel. Storm signals are shown at the high lighthouse, *see* page 9.

Both show *fixed white* lights, the higher 96 feet above high water is visible 11 miles between N. $50\frac{1}{2}^{\circ}$ E., through north, to N. $26\frac{1}{2}^{\circ}$ W. The lower light is visible 11 miles from N. $1\frac{1}{2}^{\circ}$ E., through north, to N. $29\frac{1}{2}^{\circ}$ W.

Fog signals.—A bell is sounded twice at short intervals at the high lighthouse, and four times at short intervals at the low lighthouse.

Meyers Legde lights.—From a *black* lighthouse, at 61 feet above high water, a *fixed* and *flashing* light is shown to facilitate the navigation of Dwarsgat.

The light is seen between N. $82\frac{1}{2}^{\circ}$ E., through east, and S. $64\frac{1}{2}^{\circ}$ E.; *fixed* from S. $70\frac{1}{2}^{\circ}$ E. to S. $76\frac{1}{2}^{\circ}$ E., or in the fairway; *flashing white* with *two flashes in succession*, followed by an eclipse of about *four seconds* duration from S. $70\frac{1}{2}^{\circ}$ E. to S. $64\frac{1}{2}^{\circ}$ E.; *flashing* (equal flashes and eclipses) from S. $76\frac{1}{2}^{\circ}$ E. to buoy P; and *fixed* from buoy P to N. $82\frac{1}{2}^{\circ}$ E., visible 9 miles. An additional *fixed white* light is shown between S. $\frac{1}{2}^{\circ}$ E. and S.W. $\frac{1}{4}$ W., visible 12 miles, over Watt fairway.

Fog signals.—A bell is sounded 7 times at short intervals.

Salzhorn light shows *fixed red* from S. $77\frac{1}{2}^{\circ}$ E. to S. $89\frac{1}{2}^{\circ}$ E.; *white* from S. $89\frac{1}{2}^{\circ}$ E. to N. $70\frac{1}{2}^{\circ}$ E.; and *red* from S. $70\frac{1}{2}^{\circ}$ E. to N. $57\frac{1}{2}^{\circ}$ E., and is to show the turning point of the leading lights at Eversand and Bremerhaven.

Signal stations are established at Eversand and Meyers Legde lighthouses; vessels use the International code.

Forts Brinkamahof I. and II.—At the head of the western wharf of Fort Brinkamahof I. a *fixed white* light is shown at an elevation of 14 feet above high water, visible 4 miles.

At the head of the western wharf of Fort Brinkamahof II. a *fixed white* light is shown at an elevation of 14 feet above high water. From the southern wharf of fort Brinkamahof II. a *fixed red and white* light is shown at an elevation of 40 feet above high water. This light shows *red* from S.S.E. $\frac{3}{4}$ E. to S.E. $\frac{1}{4}$ S., and *white* from S.E. $\frac{1}{4}$ S., through east, to N. by W. $\frac{1}{2}$ W.

Bremerhaven.—A *fixed white* harbour light is shown from a brick tower at the entrance of the docks; the light is elevated 114 feet above the sea, and can be seen 10 miles.

Storm signals are shown from this lighthouse, *see* page 9.

From the north side of Kaiser harbour a *flashing red and white* light is shown from a quadrangular pyramidal tower, 46 feet above high water.

The flashes and eclipses are uniform, *white* from S. 3° E. to S. 24° E.; *red* from S. 24° E. to S. 28° E.; and *white* from S. 28° E. to S. 45° E., and visible for 10 miles. The light in line with the main light leads through Wremen channel.

Geestemünde.—Two *fixed* lights are exhibited at Geestemünde, a *white* and *red* one visible for 6 miles, and a *green* one for 3 miles. When the lights are in line they indicate the entrance.

Buoys.—The buoyage of the Weser is in accordance with the German uniform system, *see* page 18. The outer leading buoy is a *red* beacon buoy with *Weser* on it, and surmounted by an oval ball and a gilt key. The inner leading buoy is a *red* spar buoy surmounted by a ball and a gilt key. Within the leading buoys at the entrance, the starboard side of the channel, entering from seaward, is marked by lettered *red* spar buoys, and the port side by numbered *black* conical buoys. Middle grounds are marked by *red* and *black* beacon buoys surmounted by a cross.

Beacons.—A beacon, 51 feet in height above low water, painted *white* on the side facing the fairway, and surmounted by a pentagon, painted *black*, has been erected on Meyers Legde, 536 yards W. by N. $\frac{1}{4}$ N. from Meyers Legde lighthouse. This beacon in line with the lighthouse leads in the fairway through Dwarsgat.

A wooden beacon, about 50 feet in height and surmounted by a *black* and *white* square, has been erected on the outer dike-land of Geestemünde. In line with the church tower of Wulsdorf, bearing S. by E. $\frac{1}{4}$ E., the beacon marks the eastern boundary of Geestemünde-Bremerhaven roadstead.

Anchorage.—At one mile eastward of the Hohe Weg lighthouse is a *red* and *black* buoy with a cross, which lies at the north end of

Robben flat, at the point of divergence of the Dwarsgat and Fedderwarder channels leading to Bremerhaven. Below this buoy, and abreast the lighthouse, is good anchorage in 8 fathoms.

The boundaries of Bremerhaven and Geestemünde anchorage, is on the north, Lehe church tower to No. 1 fort on Lang Lutjen sand. On the south, Geestemünde New church tower to Blexen church tower.

Prohibited.—Anchorage is prohibited in Dwarsgat, southward of *black* buoys 11 to 14, and Meyers Legde beacon, and northward of spar buoys N to Q; also, in the eastern half of the fairway Wurster channel, from fort Brinkamahof to Geestemünde.

No vessel is permitted to anchor between certain buoys laid down off Blexen; any infringement of the above regulations entails a heavy fine or imprisonment in default.

Torpedo and gun practice.—The area in which these periodical practices are carried out, in Weser river, is, for torpedoes, usually north-eastward of the forts on Lang Lutjen sand, the eastern boundary for that practice being marked by *yellow* buoys with *red* flags; for gun practice the area is usually between those forts and buoy Y., and firing sometimes takes place from the Brinkamahof forts on the eastern bank.

Vessels are prohibited from navigating or anchoring in the areas set apart, whilst the practices are being carried on, and any signals from the vessels of war engaged in the practice, or from the forts, must be immediately complied with. A *black* flag is hoisted at fort Brinkamahof I. when the guns at that fort are being fired; on those occasions vessels must not anchor between the Brinkamahof forts and the Lang Lutjen forts.

Tides.—It is high water, full and change, at the Schlüssel buoys at the entrance of the Weser, at 11h. 30m.; at *Bremen* light-vessel at 0h. 20m.; at Hohe Weg lighthouse at 0h. 35m.; and at Bremerhaven, 1h. 4m.; springs rise 14 feet at the entrance; $9\frac{3}{4}$ feet at the light-vessel; $10\frac{1}{2}$ feet at the lighthouse; and 11 feet at Bremerhaven.

From a series of observations taken from *Bremen* light-ship, the greatest rate of the flood stream observed was 3 knots, and the ebb 4 knots; the mean rate of the flood $1\frac{1}{4}$ knots, and the ebb $1\frac{7}{10}$ knots.

The streams turns nearly at the times of low and high water at Cuxhaven, the general direction of the flood being S. by E. $\frac{1}{2}$ E., and of the ebb N.N.W.; but not fairly through the channels, it sometimes sets across; and this fact must be borne in mind, especially in Dwarsgat.

The duration of the flood at Bremerhaven is 5h. 57m.; the ebb 6h. 28m.; at Bremen the flood 2h. 26m., and the ebb 9h. 29m.

Directions for the Weser.—From the uncertainty of the light-vessels or buoys being in position, especially during the winter months, strangers should secure the services of a pilot before entering the river.

From the westward with westerly, or south-westerly winds, the best plan to pursue is to pass in succession the islands of East Friesland, in a depth of 10 or 11 fathoms, until the Weser light-vessel or Wangeroog church and lighthouse have been sighted. With north-westerly and northerly winds, it will be better (in a sailing vessel) to sight Heligoland, and to steer such a course with respect to the tide as will keep it bearing N. by E. $\frac{3}{4}$ E. until the Weser light-vessel or Wangeroog lighthouse has been sighted.

When approaching the mouth of the Weser from the northward, Wangeroog lighthouse must not be brought to the westward of S.S.W. to avoid the shoal water on *Norder gründe*.

In hazy weather while in the vicinity of the mouth of the Weser, do not go into a less depth than 13 fathoms, *clay*. If the weather is fine and the tide flood it may be advisable to anchor, but with the ebb keep under way, as it sets off shore.

From the Key buoys steer S.E. by E. $\frac{1}{2}$ E., between the buoys, *red* to starboard, *black* to port, passing Rother sand lighthouse, and when *Bremen* light-vessel bears S. by E., steer into the main channel, where anchorage may be taken above the light-vessel in 9 fathoms at low water.

Bremen light-vessel may also be approached from the northward through the *Alte Weser* or old channel of the Weser, as it is marked by buoys, but though it is constantly used by coasters, it is not a passage to be recommended to a stranger.

At night, the more prudent course will be to keep under way and maintain a proper position, which will be determined by bearings of the lights. The Weser light-vessel, if in place, is a good point of departure for the Schlüssel (Key) buoys which lie about 4 miles S.E.

The light on Rother sand is most useful in the navigation of the entrance and lower portions of the river, showing as a *fixed* light in the fairway, except when passing southward of it.

BREMERHAVEN, a free port upon the right bank of the Weser, opposite Blexen and at the mouth of Geeste river, is the proper port of Bremen, from which place it is distant 35 miles; and 32 miles

from the Key buoys at the river entrance. There is a pilot station, storm signal station, also a telegraph, and a railway in communication with the continent and the harbour. Passenger steam-vessels trade regularly to different foreign ports. A telephone connects Bremerhaven with Bremen.

Those requiring to enter Bremerhaven hoist a flag at the main, and lower it a little if a steam tug is wanted; if wanting to enter Geestemünde hoist two flags on the mizen, one above the other.

Docks.—There are extensive wet docks, the largest is 2,782 feet long, 374 feet wide, and has $25\frac{1}{2}$ feet over the sill at high water.

The largest dry dock is 450 feet long, 58 feet wide, and has $19\frac{1}{2}$ feet over the sill at high water, *see* Dock Book.

Repairs.—There are workshops of all kinds to repair ships and machinery. Vessels of any size can be built.

Coal.—A stock of over 500 tons of steam coal is always available.

Statistics.—In 1891, the number of vessels entered was 3,164, of the aggregate tonnage of 1,673,867. The population numbered 15,000 in 1886.

Time signal.—The signal at Bremerhaven is made at 160 yards S.W. of the lighthouse. A black ball drops at 0h. 0m. 0s., or mean noon Bremerhaven time, or 23h. 25m. 43.5s., Greenwich mean time. The ball again drops at Greenwich mean noon.

Ten minutes before the signal the ball is raised to about half its height, and three minutes before the signal to its full height, 128 feet above high water. If the ball should not drop at the exact time, within three minutes after the failure of the signal, a red ball will be hoisted to the full height for five minutes, on one of the wires which supports the framework.

Geestemünde, a free port, adjoins Bremerhaven, being on the opposite side of Geeste river, which is only about 150 feet wide. There is a basin, on the sides of which are several hydraulic cranes; it is 1,734 feet long, 400 feet wide, $76\frac{1}{2}$ feet wide at the entrance, and has 26 feet over the sill. There are dry docks, with 16 feet over the sill, *see* Dock Book; one 370 feet long and 45 feet wide. Also, three building yards, where the largest iron vessels, either sailing or steam can respectively be built. Storm signals are shown here, *see* page 9.

Nordenhaven.—The navigation for large vessels ceases at Nordenhaven, on the left bank of the Weser, 4 miles above Bremerhaven. Here vessels can anchor in the stream in 6 fathoms at low water, or

lie alongside either of three piers in about 30 feet water, where steam vessels can be coaled, four or five days notice of which should be given for the coals. Nordenhaven is in communication with all parts by steam-vessels, railway, and the electric telegraph.

Vessels drawing 12 to 14 feet can proceed 21 miles higher up to Vegesack, on the right bank, which has three yards for building wooden, and particularly iron vessels up to 1,000 tons. A dry dock, 370 feet long and 50 wide at the entrance, is under construction.

Brake, on the left bank of the Weser, is a free port; vessels that cannot get to Bremen usually stop here. Vessels drawing 14 feet can lie alongside the wharf, but since the opening of the wet dock and basin it is seldom used except by fishermen and passenger boats.

Steam coal is always to be had; vessels are coaled at the quays in the dock, where there is a depth of about 19 feet. A vessel drawing $18\frac{3}{4}$ feet has entered the dock. There are two dry docks, with respectively 7 and 13 feet water on the sills at high water. *See Dock Book.*

In the stream, vessels drawing 11 feet can be moored. There are yards where vessels of 1,000 tons register can be built.

BREMEN, one of the three Hanseatic cities (Hamburg, Bremen, and Lübeck) of North Germany, is upon the Weser, which divides it into two unequal portions; the larger, called the old town, on the right, and the new town on the left bank; the communication is maintained by a bridge. Both sides of the river are lined with quays. The principal buildings are the cathedral, the church of St. Ausgarius, with a handsome steeple 325 feet high, and the old town-hall. Population in 1885 numbered 118,145.

The principal manufactures are of woollens, cotton, leather, tobacco, refined sugar, rape-oil, paper, &c., with above 100 breweries and distilleries, and several soap-boiling works and sail-lofts. There is also a considerable trade in building and fitting out vessels. At the "Weser" yard several iron-clad gunboats of 800 tons have been built.

A railway connects Bremen with Hanover, and thence with all parts of the Continent. It is the principal German port for the embarkation of emigrants for America, and next after Hamburg in commercial importance.

HELIGOLAND at the head of the bight which it names, is a common landfall, and point of departure to ships bound to the Elbe

or Weser, and is nearly equidistant from the mouths of the Weser, Jade, Elbe, and Eider rivers.*

It was captured from Denmark in 1807, and remained a possession of Great Britain until 1890, in which year it was ceded to Germany.

The island is three-quarters of a mile long, N.W. $\frac{1}{2}$ N. and S.E. $\frac{1}{2}$ S., and a quarter of a mile broad. It is a mass of red sandstone, presenting on all sides a perpendicular face seaward, 175 feet high on the west side, and its bold unmistakable character renders it an invaluable sea-mark. Heligoland has been extensively wasted by the sea, and is surrounded by broad rocky ledges, which project from its northern part nearly $1\frac{1}{2}$ miles N.N.W., and more than half a mile southward of the south point.

The town is at the south-east point of the island, partly upon the summit of the cliff and partly upon a low tongue at its base. It consists of about 400 houses, containing 2,000 persons (1881), and is much resorted to by visitors from Germany for the sea bathing.

LIGHTS.—A white circular light-tower, 60 feet high, and with attached residence, stands a quarter of a mile from the south extreme of Heligoland, and a short distance from the old lighthouse. It exhibits at an elevation of 225 feet above high water, a *fixed white* light visible in every direction at a distance of 20 miles in clear weather.

When vessels are observed to be standing into danger, a single sound rocket will be fired and repeated at short intervals until the warning is noticed. This, however, is not to be relied on, as the light-keepers may be prevented from seeing the vessel's position.

On the steps midway between the lower and upper towns, is a *fixed red* light for the use of fishermen.

Fog signal.—The fog signal station is at the north-west end, 170 feet above high water. During foggy weather a rocket explodes with a loud report on reaching a height of 600 feet *every ten minutes*. The station is half a mile distant from the lighthouse bearing S.E. by S.

Beacon.—Bull beacon, a mast with stays, 46 feet high and a triangular head, is one of the marks for the Steen, it stands S. by E. $\frac{1}{2}$ E., about 120 yards from the old lighthouse.

* See Admiralty plan :—Heligoland, No. 126 ; scale, $m=6\cdot0$ inches.

Signal and telegraph station.—There is a Lloyd's signal station at the old lighthouse, which is connected by a telegraph cable with the Continent and thus with England, the cable crosses to Sandinsel and is marked by *green* buoys with top marks.

Storm signals are shown, *see* page 9.

Hog steen (stone), the principal outlying danger in South channel, lies S. by E. nearly one mile from the south part of the island, and has only 4 feet over it at low water. From it, the old light-tower and Bull beacon appear in line N. by W. $\frac{1}{2}$ W., and Sandy island middle and south-west beacons are also in line N.E. $\frac{1}{2}$ N.

Hog steen is marked by a black spar buoy with top mark.

Caution.—Strangers approaching the southern anchorage, must not mistake a spar buoy without top mark placed over a wreck nearly on the line of the old lighthouse tower and Bull beacon, at half a mile northward of Hog steen buoy for that buoy.

Sandy island (Sandinsel), resting upon some extensive rocky ledges, has its centre bearing E. $\frac{1}{4}$ S., nearly one mile from the south point of Heligoland. From Sandy island a series of long and narrow ledges, partly uncovered at low water, named Witt Kliff, Selle, Hohe, and Peck Brunnen, extends N.N.W. for nearly 4 miles, the depth of $4\frac{3}{4}$ fathoms upon the centre of the north-west extremity lies N. $\frac{1}{2}$ W., distant $2\frac{3}{4}$ miles from the north-west point of Heligoland.

A long sandy spit drying at low water also projects 4 cables S.E. from Sandy island; its extremity is named Aade Brunnen. Between Hog steen and the end of the spit are a cluster of patches with $1\frac{1}{2}$ to $2\frac{1}{2}$ fathoms water over them, but to the southward of this spit the water deepens quickly to 5 and 8 fathoms.

Beacons.—Upon Sandy island are three wooden beacons, with stays and triangular heads, termed the middle, 54 feet, north-west, 34 feet, and south-west, 43 feet high, used for leading to the anchorages, in the North and South havens.

Buoys.—Selle Brunnen buoy, conical, *black* (surmounted with staff and cross), lies in 10 fathoms at low water spring tides, about half a mile N. by W. $\frac{1}{2}$ W., from $2\frac{1}{2}$ fathoms on the northern extremity of Selle Brunnen reef.

Nathurn buoy, spherical, painted in *black* and *white* bands surmounted with a staff and square, lies in 9 fathoms at low water springs, with N.W. and middle beacons in line S.E. $\frac{3}{4}$ S., distant $2\frac{3}{4}$ miles.

Loreley bank.—This bank lies eastward of Heligoland, and has upon its shoalest part 32 feet, whence to the southward the water

deepens abruptly, but on the north side there is a depth of $6\frac{1}{2}$ fathoms for a distance of one mile. The shoalest part lies 4 miles E. $\frac{1}{2}$ S. from the lighthouse on Heligoland, and the direction of the bank is N.N.E. from thence.

Anchorage.—A sandy ridge with 2 to $2\frac{1}{2}$ fathoms upon it at low water connects Heligoland with Sandy island and its ledges, and divides the space between them into two portions, named North and South havens. From the limited extent of Heligoland, and the small protection it affords in gales from the westward, the havens are at best but imperfect anchorages, while gales from N.N.W. blow directly through them. Of the two, however, South haven is the more exposed and contracted in space.

North haven is half a mile long, and one-third of a mile wide, with $3\frac{1}{4}$ to $4\frac{3}{4}$ fathoms in it over a bottom of stones and rock. The anchoring marks are, the lighthouse S.W., and the middle beacon on Sandy island S.E. $\frac{1}{4}$ E.; and in the South haven, with the lighthouse N.W. by W. $\frac{1}{2}$ W., and Sandy island middle beacon open a little to the northward of the south-west beacon N.E. by E. $\frac{3}{4}$ E., in $3\frac{1}{2}$ fathoms at low water.

For vessels of large draught better anchorage will be found one mile eastward of Sandy island, in 8 or 9 fathoms, fine sand, with Heligoland lighthouse bearing West. This anchorage has the advantage of being readily quitted in case of parting cables, or other emergency.

Tides.—At Heligoland it is high water, full and change, at 11h. 48m.; springs rise 9 feet, and neaps 6 feet; neaps range $2\frac{3}{4}$ feet.

Directions.—If approaching Heligoland from the westward, and intending to enter South haven, steer so as to pass at least one mile southward of the main island, and when Sandy island middle beacon has been brought a little open northward of the south-west beacon, bearing N.E., keep them so, passing northward of Hog steen buoy, until the old lighthouse appears open eastward of Bull beacon; Hog steen will have then been passed, and a N.E. by N. $\frac{1}{2}$ N. course must be steered for the anchorage.

If closing the island from south-eastward, keep the old lighthouse open eastward of Bull beacon N.N.W., leaving the buoy on the port hand, until Sandy island middle and south-west beacons have been brought in line, N.E. $\frac{1}{2}$ N., when a N.E. by N. $\frac{1}{2}$ N. course should be steered for the anchorage as before, *see* Caution, page 195.

To enter North haven, steer from the westward so as to pass $1\frac{1}{2}$ miles northward of Heligoland, and when Sandy island middle

and north-west beacons have been brought in line S.E. $\frac{1}{4}$ S., proceed with them so, and they will lead up to Nathurn buoy, and a short distance eastward of Repulse shoal, on which there is less than 3 fathoms, and between the foul ground from the north-west point of the island, and the rocky ledges extending from Sandy island; continue with the beacons in line, until the lighthouse appears nearly on with the church, and anchor a short distance to the southward in the position already indicated.

Caution.—Not more than 15 feet at low water can be reckoned upon in either of the passages by Hog steen, therefore, in the event of a swell, the flood tide should be well made before attempting to use them.

No stranger should attempt to enter either haven at night.

ELBE RIVER is one of the largest rivers of northern Europe, and the highway of a most extensive trade, it rises between Silesia and Bohemia, at a height of 4,400 feet above the sea; it intersects Saxony, a considerable portion of Prussia, part of Hanover, and divides the latter from Holstein. In direct distance the Elbe is 395 miles long, but including windings the length of the river is upwards of 780 miles.*

It receives the waters of the Iser, Schwarz, Elster, Havel, Alder, Maldau, and Eger; after its junction with the latter river it becomes navigable; and entering Saxony, it passes successively Dresden, Meissen, Torsau, Wittenburg, and Hamburg. In its course, which is northerly, it receives the Mulda and Saalite, and running through the territory of Magdeburg and the duchies of Mecklenburg and Luneburg, it discharges itself into the North sea at the head of Heligoland bight, 20 miles S.E., from that island, and about 15 miles eastward of the Weser, the intermediate space is filled with sand-banks, extending 15 miles off shore, which are partly dry at low-water, and intersected with channels used by the small craft of the country in passing from one river to the other.

Navigable depths to Cuxhaven and Hamburg.—A vessel of any draught can navigate the channel from the sea to Cuxhaven at high water neaps, and of about 25 feet draught at low water springs. The heaviest draught vessel that has visited Hamburg was 24 feet 7 inches (1890).

Steam-vessels of 21 to 23 feet draught, and sailing vessels of $19\frac{1}{2}$ to $21\frac{1}{2}$ feet, can navigate the Elbe from sea to Hamburg at high water neaps; and of 16 feet, and $14\frac{1}{2}$ feet, respectively, at low water springs.

* See Admiralty chart:—Elbe, Weser, and Jade rivers, No. 1,875.

With westerly winds sailing vessels of $21\frac{1}{2}$ feet draught have no difficulty in reaching Hamburg; with easterly winds it is sometimes difficult for a vessel of 19 feet to pass Schulau sands.

Westerly winds raise the water level in the Elbe, and easterly winds lower it.

Caution.—During the prevalence of ice, reliance cannot be placed on the light-vessels maintaining their stations, or on the positions of the buoys.

When the Outer and Elbe No. II. light-vessels and Pilot galliot put to sea on account of the ice, directly the wind turns south-westerly and removes the ice, they resume their stations, and generally before any vessel bound to the Elbe can have arrived.

The channels are buoyed in accordance with the German uniform system, *see* page 18, but strangers should take a pilot.

Ice.—In the Elbe on an average ice appears in December, and circumstances occur to interrupt the navigation of the river from the middle of December till the end of February. By the middle of March the ice has generally disappeared. Since 1872, when ice breakers were first employed, the ice has always been broken up by the ice breakers and kept in a floating condition, and the ice drift has produced no change in the depth of the water. From Gluckstadt to Cuxhaven and further seaward the Elbe is never completely closed by ice. The tides keep the masses of ice in motion.

With a severe frost of some duration the channel becomes very narrow, and a firm ice crust is formed on both sides. The ice drift is very great in the channel, especially in the narrow parts. Considerable changes in the fairway produced by the ice drift are rarely observed, but the sands lying on both sides of the channel are changed, being sometimes partly carried away and at other times enlarged.

At Hamburg, on the night of the 5th of December 1884, it blew a violent hurricane from the S.W. The masses of ice were driven together in the harbour and got blocked there, forming in several places across the river, walls of over 20 feet high. The next morning the mass began to float down the river with such rapidity that everything in its way was broken loose and carried down the river.

In 1888–89 ice had formed in the Elbe on 14th November, but the river was free on 17th November. On 16th and 30th January, 23rd February, and 5th March, icebreakers were at work, and ocean steam-vessels were beset in ice on 9th February. The light-vessel *Krautsand* first left station on 8th January, and light-vessel *Schulau* finally resumed station on 11th March. The Bosch pilot-station was

vacated from 15th to 29th January, 11th to 21st February, and 5th to 11th March. Ice was making in the river as late as 14th March.

PILOTS.—The pilots for conducting vessels into the Elbe are on board a galliot, which in fine weather, lies $4\frac{3}{4}$ miles, E.S.E., from the Outer light-vessel or Elbe No. 1 : and, in bad weather, between Elbe II. and Elbe III. light-vessels.

The pilot galliot has two masts, and carries a vane 3 fathoms long at the main-mast, and the Hamburg Admiralty flag at the mizen-mast when pilots are on board. At night, when at the outer station, shows a *red* light to ships coming in ; but, when at the inner station, inside the Elbe II. light-vessel, exhibits a light half-mast high throughout the night.

During fog or thick weather, a bell is sounded for *one minute* every *five minutes* when at anchor.

Pilots board vessels coming in according to circumstances, either in a sailing boat with the Hamburg flag flying, or in a rowing boat having the Hamburg arms on the bows.

The pilot flag should be shown at the fore by day, and a light by night when approaching the pilot galliot, *see* pilotage signals page 25, and the vessel be hove to as near as practicable to enable the boat to board conveniently.

Pilots can also be procured at the station at Bosch, and at Schulau light-vessel.

Pilot schooners cruise between Borkum flat and the Elbe.

The vessels cruise respectively eastward and within sight of Borkum flat light-vessel ; another off Norderney ; another northward and within sight of *Weser* light-ship, and a fourth between Heligoland and the Elbe. The Hamburg pilot schooners are painted white (to distinguish them from those of the Weser and Jade, which are black), have “Elbe” in large black letters upon the sail. They carry a broad pendant, and the Hamburg flag at the main. The pilots take vessels up the Elbe to Bosch, where the river pilots take charge.

The cruising pilot vessels for the Elbe carry a white mast-head light, show no side-lights, and burn three flares in quick succession every fifteen minutes.

Storm signals are shown from the following places on the Elbe :—Neuwerk, Cuxhaven, Gluckstadt, Brunshausen, Altona, and Hamburg. *See* page 9.

LIGHT-VESSELS.—There are four light-vessels at the mouth of the Elbe ; each vessel is painted *red*. The pilot galliot is painted *black*, and shows a *red* light.

Elbe No I. or the Outer light-vessel lies in 12 fathoms, at the entrance of the Elbe, is painted *red*, has three masts, and carries, when in position, a *black* ball at the mainmast head, and shows a *flashing* light of *eight seconds* duration *every twenty seconds*, which is 38 feet above the water, and visible 8 miles.

This vessel generally leaves the moorings in January or February.

Fog signal.—A steam siren sounds for *nine seconds*, an interval of *twelve seconds* will follow ; then a steam whistle sounds for *nine seconds*, and after an interval of *two minutes* the signal is repeated in the same order. Should the above signal not be given from any cause, a bell will give four long sounds in quick succession (indicating the name *Elbe*) *every two minutes*.

Elbe No. II. light-vessel has three masts, lies in $12\frac{1}{2}$ fathoms, $5\frac{3}{4}$ miles E.S.E. of Elbe No. I., is painted *red*, carries two *black* balls vertically on mainmast, and shows two *fixed white* lights *vertically* on the same mast, at the heights of 46 and 31 feet, which are visible respectively 8 and 6 miles. This vessel remains during the year when possible.

Fog signal.—A bell sounds continuously for *two minutes* at equal intervals of *two minutes* during fogs.

Elbe No. III. light-vessel lies in $6\frac{1}{2}$ fathoms, mid-channel, $4\frac{1}{2}$ miles from Elbe No. II., is painted *red*, has three masts, carries a *black* ball at the main, and shows a *fixed white* light at 36 feet above the sea, and visible for 8 miles.

Fog signal.—A bell will give three long sounds at short intervals for *two minutes*, then a pause of *three minutes*.

Elbe No. IV. light-vessel is moored near mid-channel, 4 miles below Cuxhaven, is painted *red*, has three masts, carries a *black* ball at the mainmast head, and exhibits a *fixed white* light, elevated 36 feet above the sea, and visible in clear weather for 6 miles.

Fog signal.—A bell is rung continuously for *two minutes*, followed by four long sounds, and then a pause of *three minutes*.

Caution.—During the prevalence of ice, reliance cannot be placed on the light-vessels maintaining their stations.

When Nos. II. and III. light-vessels are under repair, their position is taken by a vessel with two masts. The distinguishing flags are borne only while the vessels are in their proper stations; and by night in addition to their masthead lights, they exhibit a

white riding light forward, at a height of 6 feet above the rail. In the daytime, when a vessel, which by the colour and rigging is evidently a light-vessel, has no flag flying she is not in station, and special caution is then necessary. If vessels get out of the channel, the crew of light-vessels are instructed to attract attention by firing guns, and at night by burning blue lights, &c.

LIGHTS.—Upon Neuwerk island, which lies on the southern side of the river, and 4 miles from the mainland of Hanover, are two light-houses. The higher lighthouse is being rebuilt, 1892.

The lower lighthouse is octagonal and *black*, and exhibits a *fixed white* light, visible from the bearing East, through south, to N.W. It is elevated 59 feet above high water, and should be seen in clear weather from a distance of 10 miles.

There is a signal station at Neuwerk, connected with the German telegraph system; vessels communicate by the International code.

Kugel light, on Kugel point, $1\frac{1}{2}$ miles northward or below Cuxhaven, is a *fixed white* light, shown on a square *black* hut 28 feet above high water, and visible for 8 miles. It is shown only when Elbe No. IV. light-vessel is not in station.

Cuxhaven.—At the west side of the entrance a *white* light is shown from a circular brick tower at an elevation of 79 feet above high water, and visible 12 miles. While approaching it from the lower part of the river it shows *fixed thirty seconds, flash twenty seconds, eclipse seven and a half seconds*, visible as a flashing light from S.E. $\frac{1}{2}$ E. to S. $\frac{3}{4}$ E.; as a fixed light from S. $\frac{3}{4}$ E. to the south shore.

From the same tower is exhibited a *fixed* light at an elevation of 20 feet above high water, and visible for 8 miles, showing only between the bearings S. $\frac{7}{8}$ E. and S. $\frac{1}{2}$ W.

On the west pier from a round *white* turret at the height of 23 feet above high water, is shown a *fixed red* and *white* light, which can be seen for 3 miles. Shows *red* from S.E. by S., through south to N. by W. *White* in other directions.

UP-RIVER LIGHTS.—The following lighthouses and light-vessels mark the channel of the Elbe above Cuxhaven.

At Altenbruch, 3 miles above Cuxhaven, is exhibited from a square *white* beacon, at an elevation of 43 feet, an *occulting white* light every *thirty seconds*, visible *twenty seconds* and eclipsed *ten seconds*; it can be seen 8 miles, between S.E. by S., through south, and W. $\frac{1}{2}$ N.

Otterndorf.—Two *fixed* lights vertical; the upper light visible from S. 72° W. to S. 86° W.; the lower light from S. 72° W. to S. 76° W., and from S. 83° W. to S. 86° W.

Oste reef light-vessel is *red*, has two masts with *black* ball, and lies in 4 fathoms, $2\frac{3}{10}$ miles N. 24° E. from Belum church. Shows a *fixed white* light visible 5 miles.

A gong is sounded in thick or foggy weather.

At Brunshüttel on the north side of the river, from a beacon, a *fixed and occulting white* light is shown at 43 feet above high water and visible for 8 miles. This light shows down the river *fixed* for *twenty-five seconds* and is *eclipsed for five seconds*; up the river the light is *fixed*.

At Bösch, upon the right bank of the river, 19 miles above Cuxhaven is exhibited a *fixed white* light on an octagonal white house, at 20 feet above high water, and visible for 6 miles. It is lighted when the river is free of ice. Station for pilots.

NOTE.—For the lights further up the river, see Admiralty Light list, Part II.

Beacons.—The principal beacons used for the navigation of the Elbe to Cuxhaven are the following:—Scharhörn is 92 feet high, and has a chamber of refuge for shipwrecked people, on the sands, $3\frac{3}{4}$ miles N.W. $\frac{1}{2}$ N. from Neuwerk high lighthouse (see sketch on chart No. 1,875); North beacon, 56 feet in height, half a mile N.N.W. from the low lighthouse in line with the higher one; and East beacon (surmounted by a ball) on the north-east side of Neuwerk island, three-quarters of a mile E.N.E. from the high lighthouse; Ball beacon stands on a projection about a quarter of a mile East of Kugel point lighthouse; on the shore near Duhnen, about 2 miles West of the latter, is another beacon surmounted by a ball; and also on the two points south-eastward of Cuxhaven, Groden beacon the furthest, is nearly 2 miles from Cuxhaven, and 36 feet high.

Buoys.—The German Uniform System of buoyage and beaconage marks the channels of the Elbe, from the sea to Hamburg. See page 18.

A *white* beacon buoy, with *Westertill N* on it, and surmounted by a ball and two *red* triangles, marks the northern side of the shoal between the mouths of the Elbe and Weser. A *white* beacon buoy, with *Scharhörn N* on it, and surmounted by two *red* triangles, marks the north-west extreme of Scharhörn bank. A *white* buoy,

surmounted by two *black* triangles, and with the words *Gross Vogelsand W* on it, marks the west end of the shoal of that name.

Within the leading buoy on the starboard side at the entrance (a *red* beacon buoy, with *Elbe* on it, and surmounted by a cube), the starboard sides of the channels, entering from seaward, are marked by lettered *red* spar buoys; and the port sides by numbered *black* conical buoys.

Middle grounds are marked by *black* and *red* beacon buoys, surmounted by a cross. Above Schulau light-vessel the starboard side of the channel is marked by lettered *red* can buoys.

Tides and tidal streams of the Elbe.—It is high water, full and change, at the mouth of the Elbe at 0h., and springs rise 11 feet; at Cuxhaven at 0h. 49m., springs rise $10\frac{1}{4}$ feet; at Brunsbüttel at 1h. 53m., springs rise $9\frac{3}{4}$ feet; at Glückstadt at 2h. 52m., springs rise $10\frac{1}{2}$ feet; and at Hamburg at 5h. 10m.; springs rise $6\frac{1}{4}$ feet.

Under ordinary circumstances of weather the flood stream reaches as far as Hamburg, but when there is much water in the river it is not felt beyond Schulau or Blankenesse.

Outside and near the mouth of the river the flood stream sets north-easterly, and the ebb south-westerly, but near the entrances of the Jade and Weser the flood sets south-easterly into those rivers.

The direction of the tidal streams about the entrance of the river are considerably influenced by strong winds; and is slack hardly anywhere, but merely changes its direction, and that often to every point of the compass. At Cuxhaven the ebb commences one hour later than at the outer *red* buoy; the tide ebbs for 6h. 45m., and flows for 5h. 40m.

From a series of observations taken from the several light-ships, the maximum rate of the streams was observed from Elbe No. II. light-vessel, flood 4 knots, ebb $5\frac{1}{2}$ knots; the mean rates at the same station are: flood $1\frac{1}{6}$ knots, ebb $2\frac{2}{3}$ knots.

The general direction of the streams S.E. and N.W., the ebb making at high water at Cuxhaven, and the flood about an hour after low water there.

At Schulau light-vessel the ebb runs from $3\frac{1}{2}$ hours after high water until $1\frac{1}{2}$ hours before high water at Cuxhaven, with a maximum speed of $2\frac{1}{6}$ knots, and an average speed of $1\frac{1}{6}$ knots.

Lifeboats.—A lifeboat is stationed at each of the Elbe light-vessels Nos. 1. to IV.; at Neuwerk, at Kugel beacon, Cuxhaven, and Neufeld.

Torpedo practice.—The area in which this periodical practice is carried out, is either westward of the channel within O and P *red* spar buoys, northward of Kugel beacon ; or eastward of the channel, abreast Elbe No. IV. light-vessel ; and is marked inshore of the above buoys by *yellow* mooring buoys surmounted by *red* flags.

Vessels are prohibited from navigating or anchoring in the areas set apart whilst the operations are going on, and any signals made from vessels of war engaged in practice must be immediately complied with.

DIRECTIONS.—Approaching the Elbe.—With westerly and south-westerly winds it is advisable, after having sounded upon, or identified Borkum flat by the light-vessel, to steer easterly along shore until midway between Heligoland and Wangeroog, when the outer light-vessel at the mouth of the Elbe will bear E.S.E., about 13 miles ; make this course good by due allowance for the tidal streams, and sound continually. In this track, the depths will be found to decrease from 17 to 12 fathoms over bluish clay, to near the light-vessel ; but if 9 or 10 fathoms, sand, been obtained, at once keep away northerly to regain the former soundings.

The quality of the bottom between the tail of Grosser Vogelsand and the Scharhörn is variable ; along the edge of the latter is a bed of clay ; there is also similar clay to the northward, intermixed with mud, sand, and broken shells ; and if the vessel be going rapidly through the water, the same ground will seldom be obtained by two consecutive casts.

When Elbe No. I. or Outer light-vessel is sighted, keep it bearing well southward of East to avoid the south shore, sounding continually until objects marking the mouth of the Elbe, have been clearly identified.

A common plan of those well acquainted with the Elbe, is to steer well to the southward from Heligoland and get into 12 fathoms, dark blue clay, which depth will lead to Elbe No. I. light-vessel.

Do not approach the Norder gründe nor Scharhörn sand in less than 9 or 10 fathoms, the latter is very steep ; in bad weather the sea breaks on the edge of this sand, which renders it easy to recognise.

With north-west winds, make Heligoland ; take a departure from it and shape a course for the Elbe Outer light-vessel, allowing for the tide, and paying particular attention to the soundings and nature

of the bottom ; if the weather is foggy probably the signals of the light-vessel will be heard.

In the summer season it is advisable to enter the Elbe either early in the morning or in the afternoon, so as to avoid the beamy light of mid-day ; but, though the day should generally be preferred for entering the river, there are exceptions to the rule, especially in the height of summer, when the fresh and clear nights are more favourable for sighting distant objects, owing to freedom from the glare of the sun and the exhalations from the sea.

Vessels getting on the Grosser Vogelsand in west or north-west winds are usually lost, with their crews ; whereas, if stranded upon the Scharhörn, the men have a chance of reaching the life-beacon, and are thus rescued.

In every direction seaward of the mouth of the Elbe there is good anchoring ground, and many a vessel but scantily provided, has, by anchoring and cutting away the masts, ridden out a heavy north-west gale when others running for the Elbe have been lost.

The best time of tide for entering the Elbe is about one-third flood when the stream runs directly in, but in heavy westerly winds the time of one hour before high water is to be preferred, for then, on account of the rise of tide, vessels of ordinary draught may, if they happen to diverge from the proper track, pass over several of the shoals without touching, and should they eventually touch the ground they are not long exposed to a heavy surging sea, and there is consequently less risk to life and property.

A gale from north-westward opposed by the ebb stream causes the most dangerous sea at the mouth of the Elbe, and heavy riding abreast Cuxhaven.

Directions from the sea to Cuxhaven.—Pass northward of the Outer light-vessel, and steer E.S.E. for the Pilot galliot ; if not at the outer station, then steer for Elbe No. 11. light-vessel, which may be passed on either side ; and the Pilot galliot will be found about a mile or two above. If the galliot cannot supply a pilot, strangers will do well under all circumstances to anchor, and obtain one as soon as possible. But in case of proceeding on without a pilot, the light-vessels and buoys will guide.

By night, the navigation is safe only as long as the light-vessels are at their stations, the courses being the same as by day from light-vessel to light-vessel. A sharp look-out must be kept for shipping as there is much traffic on the river.

CUXHAVEN is situated on the south point of the entrance to the Elbe. Vessels wait for favourable winds in the road, where there is good anchorage abreast the town. When the river is frozen, passengers embark and land at Cuxhaven. Packets call regularly bound for London, Havre, and Rotterdam. There is a railway to Hamburg. Population in 1885 numbered 4,400. It is a free port, with no harbour dues.

A telegraph connects the port with Altona, Glückstadt, and Hamburg.

The harbour admits vessels of 18 feet draught at ordinary tides, and is frequented as a harbour of refuge, having means to make small repairs to the hulls of either wooden or iron vessels, or to machinery. There are slips suitable for vessels of about 300 tons.

Coal.—There is always a stock of coal in store. Vessels can coal alongside the wharf, where there is 8 feet at low water, or in fine weather in the road.

Semaphore station—On the dike, near the Alte Liebe, is an iron mast with a yard, at both arms of which is a vertical circle. The circles are divided into points with a finger to indicate the direction of the wind; the eastern circle is marked with an H for Heligoland, and the western circle with a B for Borkum. The north is above and the south below, the other points corresponding to their actual relative position. The force of the wind is shown by six arms at the top of the mast on both sides. When extended towards east, the force of the wind at Heligoland is indicated, and when to the west the force at Borkum. Each arm expresses an even number, that is, if one arm is raised the force is two, if two arms the force four, and if three arms the force is six; if the force is an uneven number the next higher even number is always shown. If from any cause the signal cannot be made from either of the two places, a red ball will be hoisted on that side.

An additional semaphore on Alte Liebe dike signals to approaching vessels the occasional closing of the entrance. In this case, the arm of the semaphore will be placed in a horizontal position pointing towards the river. While this signal is shown, entering the harbour is prohibited, as is also going alongside Alte Liebe dike. This regulation does not extend to passenger steamers, nor to special cases for which permission has been obtained.

Quarantine.—Cuxhaven is the quarantine station for vessels bound up the Elbe.

Time signal.—The time signal is shown near the lighthouse ; a ball falls at noon mean time Cuxhaven, equivalent to 23h. 25m. 10s. Greenwich meantime. The ball is again dropped at Greenwich mean noon.

North sea and Baltic canal.—This canal now under construction was commenced in 1887, principally as a part of the defences of the Empire, by joining the chief naval stations. It leaves the Elbe at nearly 2 miles above Brünsbüttel and enters Kiel bay at Holtenau. The length of the canal is 61 nautical miles, 118 feet wide, and has a normal depth of 20 feet, with a lock at the ends. It goes through to Wittenburgh, on the Eider, then follows the course of that stream, from which it diverges at Steinrade, and then merges into the Eider canal till it reaches Holtenau. The dangers of the Skaw route will thus be avoided and the passage of vessels from Hull and ports to the southward of that place be considerably shortened.

HAMBURG, the most important of the German ports, is the commercial emporium of the Empire, and the greatest mercantile port on the continent of Europe ; it is on the right bank of the Elbe, about 70 miles from its mouth. Its shape is nearly that of a semi-circle, the diameter being formed by the Elbe, while the curve is marked by Alster river. Hamburg was surrounded by strong walls, but these, and all the fortifications connected with them, have been levelled, and the space which they occupied converted into spacious roads and gardens.

The principal buildings are the church of St. Nicholas, a noble gothic structure, with a lofty tower and spire ; St. Peter's church ; St. Michael's church, with a spire 456 feet high, and consequently one of the loftiest in Europe ; St. Cothenues, with a spire 390 feet high ; and two English churches ; the Exchange, a noble edifice, besides numerous other structures devoted to literature, science, and art.

The city of Hamburg was incorporated in the German custom-house league in the year 1888, but a large portion on the northern shore of the Elbe, including the public quays and the greater part of the southern shore remains a free port, so that vessels and cargoes coming to or leaving Hamburg, will not be subjected to the Custom House regulations. The free port is separated from the town by a canal. It is one of the principal German emigration ports. In 1884 the population of Hamburg and its suburbs numbered 467,258.

Hamburg does not depend much on manufactures ; it produces, however, linen, cotton, and silk goods, soap, tobacco, refined sugar, iron, tin, and copper ware, &c. The trade is very extensive, including, to a greater or lesser extent, every article which Germany is able to sell, or requires to buy, and is greatly facilitated by means of communication both with foreign countries and with the interior. A great drawback to the trade is the want of a sufficient harbour, the vessels being obliged to lie in the river, within a space railed off from the fair-way, and protected from the current by means of piles. Vessels drawing not more than 15 or 16 feet can lie afloat at the wharves or in the river during ordinary tides ; but those of greater draught ground in soft mud. Extensive preparations for new quays, new harbours, warehouses, &c. are in progress.

Its canals, &c., give it free and uninterrupted communication with the Baltic, by the basin of the Oder ; and through North Germany by the Vistula into Poland &c.

Coal.—Steam-vessels can coal at the Magdeburg harbour wharf, where the depth at low water is 10 feet ; those lying in the harbour or at the public quay must coal from barges.

Quarantine.—Vessels undergo medical inspection at Cuxhaven.

Time signal.—A time signal is shown on the tower of a store-house on the Kaiser quay, 180 feet above high water and 170 feet above the ground. Ten minutes before the signal a black ball is hoisted half way up, and at three minutes before, it will be close up. The ball will fall every day at 0h. 0m. 0s., Greenwich time, or 0h. 39m. 53·6s. mean time of the Hamburg observatory. If the time ball should not fall at the appointed time, a red ball will be hoisted as far up as the upper edge of the structure within five minutes of the failure of the signal, and remain up for five minutes.

Hospital.—There is a hospital near the harbour for the exclusive use of seamen, at a low charge ; also a sailors' home, and a special British sailors' institute.

Trade.—The imports consists of sugar, coffee, tea, rice, tobacco, cotton, indigo, dye-woods, wines, spirits, spices, coal, corn, cattle, oil, oil cake, tallow, hides, wood, iron, copper, guano, silk, flax, hemp, linen, wool, British manufactured goods, &c., valued at 117,012,651*l.* in 1889 ; and the exports of grain, seeds, butter, wool, salt provisions, cattle, German manufactures of all kinds, Rhenish wines, &c., valued at 110,517,030*l.* in 1889. The commerce with Great Britain is very large.

Communication.—There are regular lines of steam-vessels to British, French, Dutch, Belgian, Spanish, Italian, Swedish, and Norwegian, Russian, and Turkish ports, to New York, the West Indies, Chili, Peru, Buenos Ayres, Rio de Janeiro, Valparaiso, the East Indies, China, Japan, Africa, and Australia.

Railways connect Hamburg with the outports of Bremerhaven, 35 miles distant, with Rendsburg and Kiel, Schwerin, and Rostock, and with Berlin, and all East and South Germany. There is telegraphic communication with all parts of the world where wires are laid.

Docks.—Hamburg has dry docks, one 540 feet long, 52 feet wide at the entrance, and 15 feet water on the sill. *See Dock Book.* It has several patent slips, that can take vessels of from 400 to 1,150 tons.

Repairs.—There are building yards, in which ships of large size are built; there is also the Reiherstieg iron ship and engine building yard, where sailing and steam-vessels of large size have been built. On the banks of the river, in the vicinity of and below Hamburg, there are other yards where vessels of moderate size and small craft are built and can be repaired. Repairs of every description or to any extent can be carried out.

There is a crane capable of lifting 150 tons.

Deviation of the compass.—Opposite Brunshaussen, about 17 miles below Hamburg, are five *black* iron buoys; the centre and largest one for securing the vessel to, is in the shape of a pear, and lies in 4 fathoms at low water. From it the *true* bearings and distances of the following objects are:—Haselau church, N. 60° 56' E. distant 3½ miles; Wedel, S. 62° 38' E., distant 6½ miles; Steinkirchen church, S. 29° 25' E., a little over 5 miles; Hollern church, S. 15° 30' E., distant 2¾ miles; Stade church, S. 48° 26' W., distant 3 miles; Bützfleter church, N. 59° 50' W., nearly 2½ miles; and Schwarz Tonnen sand beacon, N. 26° 17' W., nearly 4¾ miles. For determining the deviation, the three most distant places are the best when the weather will permit their being seen. The variation, 12° 6' W., in 1892, decreasing 7½' annually.

NORDER ELBE.—The wide opening between the north side of Grosser Vogelsand, and the flat of Boschsand, is divided into two branches; the northernmost, Falsche tief (False deep), is dangerous to vessels, which in thick and unsettled weather mistake this inlet for the principal channel of the Elbe.

The southern branch, the Norder or North Elbe, was important to navigation, but having silted up it is no longer navigable. The Neufahrasser is a narrow passage, leading from Falsche tief, and is used only by coasters.

Buoys.—Falsche tief for 7 miles in a south-easterly direction from the outer buoy (*red* and *black*, with staff and ball), is marked according to the German Uniform System. *See* page 18. The further extent of Falsche tief towards Klotzen loch which leads into the Elbe, is marked by beacons.

CHAPTER VII.

ELBE RIVER TO HORN REEFS.

VARIATION 13° West in 1892.

Decreasing about 8' annually.

The greater portion of the coast between the Elbe and Horn reefs consists of low marshy ground enclosed by dikes, sheltered by a range of islands and sand-banks, and surrounded by extensive flats, which partly dry at low water, leaving narrow channels between them. Such is the character of this part of the coast; and, therefore, a knowledge of the tides is of the utmost importance to its navigation.*

The western side of the outer islands, as also the coast of Eiderstedt in Schleswig, consists of sand-downs, and on the whole extent of this coast there are but few objects sufficiently high to be visible from a vessel outside the channels, except the beacons.

The principal traffic is by the Eider, during the summer months, and consists in the export of cattle from Tönning. The traffic on the Hever is to Husum, which can only be reached by flat-bottomed vessels of light draught.

There is regular communication by steam-vessel between Sylt Föhr, and other islands from the towns on the adjacent coast, and they are also included in the German telegraph system.

Pilots.—No branch pilots are established on this coast, except those at the mouth of the Eider, who are required to take vessels to the Hever also; but it is usual for fishermen from Fano island to take charge of vessels bound to all places in its vicinity, and they attend when the proper signal is made off Graa deep.

* See Admiralty charts :—North sea, No. 2,182*a* and 2,182*b*; scale, $m = 0.1$ of an inch; Eider river to Blaavand point, No. 1,887; scale, $m = 0.52$ of an inch; Elbe, Weser, and Jade rivers, No. 1,875; scale, $m = 0.5$ of an inch; and Baltic sea, No. 2,842*a*; scale, $m = 0.12$ of an inch.

Buoys and beacons.—The buoyage of all the channels on this part of the German coast is in accordance with the Uniform System adopted by Germany (*see* page 18).

The small beacons or poles standing in the Watts (channels navigable by small craft of not more than 6 feet draught, and only at high water) are placed on the west side, and, accordingly, are to be left on the port side when coming from the southward or eastward, and to starboard when coming from the northward or westward, if not otherwise directed. The first and the last of these beacons carry two or more horizontal brooms, to distinguish them from the rest.

The buoys are placed on the first of March, and removed on the 15th of November, unless compelled to deviate from this rule by ice or stormy weather.

Caution.—As changes are constantly going on in the channels, the position of the buoys are altered to meet the requirements of navigation.

Tides and tidal streams.—The rise of the tide increases on going to the southward, from the Horn reefs to Heligoland bight; in the offing the time of high water full and change is at 0h. 0m.

Outside the islands, as well as between them, the tide flows and ebbs every $6\frac{1}{2}$ hours; but frequent irregularities occur, from the influence of strong winds, particularly those from the eastward and westward. The highest tide takes place at the third transit after the full and change; but experience shows that westerly winds occasion a higher, and easterly winds a lower tide nearly in proportion to the force of the wind.

In the offing, at from 10 to 15 miles from the islands, the stream is never slack, but takes a rotary character; the ebb stream sets first N.N.W., then works round through N.W. to W. by S. The flood first sets S. by W., and works round to S.E.

The direction of the streams is given for every hour of the tide, in the Admiralty tide tables, pages 146-7, compartments xvi. and xvii.

On the west shore of Sylt the ebb stream sets northward from Hornum, and southward from Lister deep, meeting off Westerland; and the flood stream separating at this point, flows north and south round those points of Sylt. These streams extend about 4 miles off shore.

ANCHORAGES.—Those acquainted with the inlets, and fishing vessels seeking refuge in bad weather, anchor at the following places; but it is not advisable for strangers to seek for anchorage between Horn reefs and the Elbe.

In the Eider, shelter is found south of Vollerwiek.

In the Hever, there is anchorage under Pelworm, and only south-west winds raise a sea. It is quite sheltered under Nordestrand, but the space is very confined.

In Schmal deep, under Seesand ; in Norder Aue, off Amrum ; and in Wyk roads, sheltered anchorage is found, except in winds from between south to south-west. Also in Vortrapp deep under Hornum.

Lister deep is the easiest accessible, and has safe anchorage off Königshafen, sheltered from all winds.

SÜDER and NORDER PIEP are inlets between the extensive shallows westward of Ditmarschen, leading to the havens Büsum, Warwerort, Wohrden, Meldorf and Barlt ; the southern inlet has at its entrance a sufficient depth for vessels of deep draught, and thus affords anchorage and shelter ; the northern inlet is barred by a flat $1\frac{1}{4}$ miles wide having a depth of 13 feet.

Beacons.—On the southern side of Süder Piep a refuge beacon, 67 feet high, consisting of a mast with four supporters carrying a triangle of trellis, with a sphere above it, stands on Bösch sand, which is dry at high-water, ordinary springs. The beacon is fitted with a chamber containing bread and water for shipwrecked crews. there is also a flag which can be hoisted as a signal for assistance.

On Blauort sand, on the northern side of Norder Piep, there is a similar structure 69 feet high, carrying on the top a cube of trellis.

Süder Piep leading buoy is a *black* beacon buoy, with *Süderpiep* on it, surmounted by two balls. The channel within is marked by lettered *red* spar buoys on the starboard hand, entering from seaward, and by numbered *black* conical buoys on the port hand.

Norder Piep leading buoy lies N. by E., distant $5\frac{1}{4}$ miles from Süder Piep leading buoy. This leading buoy is a *black* beacon buoy, with *Norderpiep* on it, and surmounted by a ball. The channel within is marked by numbered *black* conical buoys on the port hand, entering from seaward.

Tides.—It is high water, full and change, at Blauort sand at 0h. 38m., springs rise 12 feet. At Büsum 1h. 21m., springs rise 12 feet.

Directions.—By paying attention to the soundings, and to bearings of Heligoland, the outer light-vessels of the Elbe and Eider, Bösch sand beacon, and the large tower of Neuwerk, the mariner will, provided it is clear weather, be able to shape a proper course for the Süder Piep.

Coming from the westward, Heligoland lighthouse should be kept N.W. by W., while it is visible, and when the outer light-vessel of the Elbe bears S.S.W. $\frac{1}{2}$ W., distant 6 miles, steer E. by S., which will lead to the northward of the fairway buoy, to mid-channel in 8 fathoms, blue mud and mussel shells.

When working into Süder Piep, do not stand into less than 5 fathoms on the south side, as the Bösch sand is steep-to, and on the north side do not stand too near the bar that borders Norder Piep, as the flood tide sweeps towards that inlet.

Büsum haven.—The depth in this haven at high water ordinary springs is 8 feet, and dries about 4 feet at low tide.

There are several passages with shallow water into the Eider across the watts or flats, but only practicable at high water to small craft; but these gullies in the sand being merely marked by a few stick beacons, and subject to frequent changes, should only be attempted by those well acquainted with the localities.

Büsum haven is a lifeboat station.

LIGHT.—Büsum harbour light is *fixed white*, and visible for about 5 miles; the light is exhibited, at an elevation of 32 feet above high water, from a mast on a house on the dike westward of the haven.

Miele river is a continuation of Norder Piep, to the eastward, and afterwards to the southward along the coast, and gives access to the havens Warwerort, Wöhrden, and Meldorf.

From Busum, the inlet branches off to Warwerort haven, being two-thirds of a mile long, first N.N.E. and then with several sinuosities, which make the navigation difficult. The small beacons standing on the western side of the inlet, should be kept to port when entering. Outside the sluice, the harbour is formed between two wooden piers of short extent, and a few posts to make fast to, are placed along its edges. The depth in the harbour at ordinary high water is 8 feet.

The inlet continues to Wöhrden, which is distant 2 miles from Warwerort. Along the north side of the inlet there are small beacons, which should be kept to port; and vessels drawing 5 feet may use this haven, but it is difficult to leave with westerly winds. Since König Christians Koog has been surrounded with dikes, vessels may load or unload there, but the custom-house is at Wöhrden.

Meldorf haven has a depth of 10 feet at high water.

EIDER RIVER discharges its waters between the far-extending shallows of the Ditmarscher gründ, and of those projecting from Eiderstedt. At the fortress of Rendsburg, the North sea and Baltic,

canal branches off from this river. The river runs with several sinuosities and bendings from Rendsburg, past the towns Friedrichstadt and Tönning.*

Caution.—The channel is always changing, and alterations in the buoyage of the river entrance is made to meet these changes; strangers are cautioned on no account to attempt to enter the river without a pilot.

Navigable depths.—A vessel of $13\frac{1}{2}$ feet draught can navigate the channel from sea to Tönning at high water neaps; at low water there are usually breakers on the bar, and no vessel should enter.

In 1891, the depth on the bar at low water was about 9 feet.

Ice.—The dates of the complete freezing as well as of the melting of the ice above Tönning differs greatly.

In 1889 navigation closed in the Eider on 9th January, was still closed to sailing vessels on 11th February, and on 20th March the upper Eider was full of drift ice. Navigation for steam-vessels opened on 1st February.

LIGHT-VESSELS and LIGHTS.—A light-vessel is moored in 7 fathoms about 8 miles outside the bar, in lat. $54^{\circ} 16' N.$, and long. $8^{\circ} 18\frac{3}{4}' E.$; has three masts, is painted *red* with *Eider* in *white* letters on sides; on each mast head is a *black* ball, and when not in position a *black* flag with a *white* square, will be hoisted on the mizen mast.

From the main is exhibited a *fixed white* light, at an elevation of 35 feet, which is visible 8 miles in clear weather. Within one mile the light may appear as two lights close together and at the same height.

Fog signal.—A siren is sounded for *five seconds* duration *every minute*. Should the siren be out of order, the signal will be a bell, sounded for a period of *two minutes every ten minutes*. When signals are heard from vessels, the bell signal is repeated *every five minutes*.

The Inner light-vessel is moored inside the bar in about 2 fathoms, at the main entrance of the river, about $9\frac{1}{2}$ miles S.E. by E. $\frac{3}{4}$ E. from the outer light-vessel; is painted *red* with a *white* line, and *Eider* in *white* letters on sides, and carries a ball at the fore, 62 feet above water.

* See Admiralty chart :—Eider river to Blaavand point, No. 1,887, scale $m \equiv 0.52$ of an inch.

The light is *fixed*, elevated 33 feet, and is visible 8 miles; it is exhibited from about the end of February to the end of November; the light-vessel is removed during the winter season. In thick weather a gong is sounded.

Tidal and pilot signals are made from the Inner Eider light-vessel.

A red pendant at the foretop— signifies - - - - -	Entrance is clear.
A double cone at the middle of the yard (crossing point of yard and mast) - - - - -	6½ feet water on the bar.
A double cone at the middle of the yard, and double cone above— signify - - - - -	9¾ „
A double cone at the middle of the yard, and a double cone below -	13 „
A horizontal cylinder at the middle of the yard—signifies - - - - -	16¼ „
A horizontal cylinder at the middle of the yard, and double cone above— signify - - - - -	19½ „
A horizontal cylinder at the middle of the yard, and double cone below -	23 „
A horizontal cylinder at the middle of the yard, and cylinder above - -	26¼ „
A horizontal cylinder at the starboard (from seaward) yard arm—signifies 1½ feet more water than is shown by signal.	

EXAMPLE.—Red pendant at the foretop; one double cone at the middle of the yard with double cone below; a horizontal cylinder at the starboard yard arm (from seaward)—signify—entrance clear, with a depth of 14½ feet.

With the tide rising, the signal is not altered until the water has risen 1½ feet; but with the tide falling, the signal is altered when the water has fallen below the last signalled depth.

In heavy weather, the yard of the light-vessel has to be topped up or struck—the red pendant at the foretop then only indicates whether the bar is passable.

The pilot signals shown from the foretop of the light-vessel :—A red flag—indicating pilots can be obtained :—A white flag—no pilots on board.

Vollerwiek upon the embankment below Vollerwiek, at the north side of the river about 8 miles above the entrance, are two small *fixed white* lights, visible 4 miles. The lights in line lead in mid-channel.

On the embankment in front of Vollerwiek, there are two *fixed white* lights visible 4 miles; the lights in line lead through the western part of the Purren ström. The positions are altered as the channels change.

Tönning.—On the embankment are two small *fixed white* lights, visible 4 miles; when in line the lights lead through the eastern part of the Purren ström. The positions are altered as the channels change.

NOTE.—Whilst the navigation of the river is interrupted by ice the lights at these last three places are not exhibited. It may also be remarked that the channels, and consequently the leading lights, are constantly liable to change.

Beacon.—St. Peter's beacon, 25 feet high, erected on a sand-hill S. $\frac{1}{3}$ E., a long mile from St. Peter's church, in Eiderstedt, is a pyramidal wooden beacon 63 feet above high-water, and carries a pentagonal trellis, which faces S.W. by W.

Buoys.—The buoyage of the Eider is in accordance with the German Uniform System, *see* page 18. The outer leading buoy is a *black* and *red* beacon buoy, with *Eider* on it, and surmounted by a double ball; the inner leading buoy, is a *red* beacon buoy, surmounted by a double ball; within the leading buoys, the starboard side of the channel, entering from seaward, is marked by lettered *red* spar buoys and poles, and the port side by numbered *black* conical buoys. Middle grounds are marked by *black* and *red* beacon buoys, surmounted by a cross.

Pilots reside on board the Inner light-vessel, and when the signal is made, they attend, and if prevented from coming alongside on account of the sea, the boat leads, and the vessel must follow until arriving in smooth water in the river, where the pilot may be taken on board.

After the removal of the light-vessel on account of the ice, a pilot steam-vessel cruises in the mouth of the river until the navigation is entirely closed.

Lifeboat.—A lifeboat is stationed on board the Inner light-vessel.

Tides.—It is high water, full and change, at Eider river entrance at 0h. 0m., springs rise 10 feet; at Tönning at 1h. 55m., springs rise 11½ feet.

Directions for the Eider.—On approaching the outer shallows, the objects that will be recognised if the weather be clear, are Tating church, having a large tiled roof and a high painted steeple, together with St. Peter's mill, and Wesselburen church in Norder Ditmarschen; the shore in front having a dark hue. By bearings of these landmarks, the position of a vessel may be ascertained, but Heligoland is the most useful object for making the Eider or any other of the inlets between the Hever and the Elbe.

Approaching the entrance to the Eider from the westward, Heligoland lighthouse should be kept bearing W. $\frac{1}{4}$ N. until lost sight of, which will lead about 2 miles southward of the outer light-vessel, and on to the fairway buoys. Near the mouth of the river, the depth is 5 to 6 fathoms, light-coloured sand, with shells and ooze, whereas further northward the soundings are grey sand.

Strangers should take a pilot before entering the river, on account of the tides, changes in the river, &c., *see* page 215.

Abreast Vollerwiek there is a good roadstead or stopping-place to await a change of wind or tide.

Between Vollerwiek and Tönning the channel is named Purrenström; it is little more than one cable wide, with a depth of 1½ to 3¼ fathoms, and shallows on both sides, marked by perches. The two lights in front of Vollerwiek, and those at Tönning, are intended to lead through this channel. In the roads abreast Tönning harbour there is a depth of 18 feet at low water.

Tönning harbour.—The harbour is nearly dry at ordinary low water; however, the bottom being ooze, vessels are not injured by being left dry. At high water the depth is 10 feet in the middle of the harbour. There are slips capable of taking up vessels of 8 to 9 feet draught, for repair.

A railway connects Tönning with the northern and eastern lines.

Storm signals are shown from a signal post near the entrance to the harbour. *See* page 9.

Coal can always be obtained.

Lifeboats.—A lifeboat is stationed near Kating Siel, and one a little to the south of St. Peter's beacon.

The Lower and Upper Eider.—The navigation further up this intricate river, from Friedrichstadt to Rendsburg, is difficult, and is more frequently performed by tracking the vessel along, than by

using sails. The size of the vessels which are able to pass through the Eider canal depends on the locks, which are 98 feet long, 26 feet wide, and have a depth of $9\frac{3}{4}$ feet.

The Lower Eider from Tönning to Rendsburg is in general practicable to vessels drawing 10 to 11 feet. The shoalest places are in Breiholz reach, where, from a continuance of easterly gales, the water may fall 6 feet.

Friedrichstadt harbour has a depth of 10 to 12 feet, and Rendsburg harbour 11 feet at high water.

In the Upper Eider, from Rendsburg harbour to Föhrde, at the entrance of the Schleswig Holstein canal, the depth is in general 15 to 16 feet, except at the powder magazine of Rendsburg and at Föhrde, where it is only $8\frac{3}{4}$ feet.

HEVER RIVER.—The several entrances to the Hever have undergone much change, the principal channel lies between those formerly known as the New and the Old Hever Ström, and is now called the Middle Hever; it is buoyed up to Husum road, abreast Nordstrand island; also to Pellworm by the North Hever.

South Hever, between the Outer Quagegrund on the north and the shoals bordering the mainland of Eiderstedt on the south, is also buoyed up to the junction with the main stream.

Depth on the bar.—In 1889 there was a depth of $14\frac{1}{2}$ feet over the bar at low water, at the Middle Hever; this is, however, liable to changes.

Beacons.—St. Peter's beacon, page 217, will be found of service when making for the Hever.

Süderoog is a conspicuous *black* beacon erected on Süderoog sands north-east of the entrance, which can be seen in clear weather for a distance of 9 miles; the beacon is 74 feet high, the lower portion forming the main support of the beacon, which is in the form of a triangular prism, two sides of which face the sea, and the third the tower of Pellworm, the outer angle is directed towards the fairway buoy of the Middle Hever; the beacon has two distinguishing marks at the top, the upper one being a ball, and the lower when seen from the Middle Hever fairway buoy will appear as a mast, but if either north or south of this direction the lower mark will show the form of an hour glass. In the beacon there is a refuge chamber for shipwrecked crews.

Pellworm tower (an old church) on the west side of that island; and Seesand beacon, page 221, also assist the navigation of this low and dangerous coast. See views on Admiralty chart, No. 1,887.

Buoys.—The buoyage of the Hever is in accordance with the German Uniform System. The South Hever leading buoy is a *red* beacon buoy, with *Süder Hever* on it, surmounted by a ball. The Middle Hever buoy is a *red* beacon buoy, with *Mittel Hever* on it, surmounted by a ball and hour glass. Within the leading buoys, the channels of the Hever are marked by lettered *red* spar buoys on the starboard side, entering from seaward, and by numbered *black* conical buoys on the port side.

The position of these buoys are all liable to be changed.

Tides.—It is high water full and change at Husum, at 2h. 20m., springs rise 11 feet; and at Pellworm, at 1h. 50m., springs rise 10 feet. The flood sets in the direction of the channel.

Directions.—Those approaching the entrance of the Hever from the westward should get bearings of Heligoland, those from the northward may be guided by bearings of Seesand beacon, and those from the southward by bearings of the light-vessels at the mouth of Eider river, and St. Peter's beacon on the main.

Close outside the mouth of this river, as also to the northward and southward of it, there are 5 to 6 fathoms, fine gray sand, and, in anything like clear weather, the shore at Ordling and St. Peter's is visible, though the sand-downs are low, and with a light yellowish tint.

St. Peter's church and mill are the most conspicuous, and, in very clear weather, Ordling church with its low tower and short spire shows between the sand downs. Pellworm tower and the house on Süderoog are just visible on the horizon.

It would only mislead to offer any particular directions for navigating the several channels of the Hever; so many changes have taken place in the position of the banks, and which are constantly going on, that any given course of to-day might be the means of running the vessel into danger a short time hence.

A pilot's assistance is essential.

Husum.—Inside the outer beacon of Husum river there are smaller ones, which in entering are to be left to starboard.

There is a small anchorage in Husum road in 18 feet at low water, and good holding ground sheltered from all winds, with Hattstedt and Schobüll churches in line.

Vessels drawing 8 feet can reach Husum at high water, but those over 115 feet in length cannot swing.

The principal traffic is the export of cattle; and during the summer months there is regular steam communication with the off-lying islands.

Coal can be obtained.

Inner channels.—All the inner channels from Eiderstedt to Fanö which traverse the sand-banks and lead from the islands and the shore to the principal channels and the sea, may, as a general rule, be used at high water by coasters drawing from 3 to 5 feet. They are ordinarily marked by posts with brooms.

SEESAND is a large white sand-bank, liable to change, dry at high water, or only covered at high spring tides in boisterous weather. Its north-eastern spit lies about 4 miles S.S.W., from the south-east point of Amrum island. The extent of the bank is $1\frac{1}{3}$ miles N.E. by N. and S.W. by S., and rather more than half a mile wide.

Beacons.—A wooden beacon is erected on Seesand, formed like a pyramid surmounted by a large flat topped circular board; its height is 62 feet, and it may be seen 10 to 12 miles when the weather is clear, like a cutter with a top-sail.

The upper part of the beacon is so contrived as to afford a refuge for shipwrecked mariners, having a supply of water and bread, and a flag to make signals for assistance with on the mast.

This beacon being the most conspicuous mark to be seen when outside the shallows between Amrum and Eiderstedt, is of great importance, as it can be distinctly seen from vessels in depths of 6 or 7 fathoms, not only to warn seamen that have been set too near the coast, but also as a mark for making the entrances to the west and south of Amrum.

Besides this beacon, there is Amrum lighthouse to the north, and on the west side of Pellworm island, the old square tower in ruins before mentioned, flat on the top, but it is not visible far off, and even in clear weather it is seen only just from the outer edge of the shallows.

A beacon, consisting of a wooden cross surmounted by a four-sided figure, has been erected on the highest sand hill near the western point of Amrum island.

SCHMAL DEEP is the deepest of the three inlets between Amrum and the Hever. Land deep and Rütergat are unbuoyed, and should not be used.

It has about 20 feet of water, but is not more than a quarter of a mile wide; its outer entrance is between Back sand and Tusch gründe, it then passes between Seesand and Junge Jap, and is then divided into two channels, one, the Norder Aue leading to Amrum and Wyk harbours and Dagebüll, the other leading to Bordelum.

It is very important for vessels obliged by stress of weather to look for refuge inside the shallows, between which, in this inlet, there are several good anchorages; it ought to be attempted by sailing ships, only with the wind from S.S.W. to N.W. and the weather such that the buoys may be distinctly seen, which is an indispensable condition when standing for this narrow and intricate channel, surrounded as it is by dangerous shoals and breakers.

LIGHTS.—Amrum island lighthouse, on the summit of the south-west part of the island, is round and of a dark *brown* colour, 137 feet high, and exhibits a *white* light showing a *flash of six seconds* duration *every twenty seconds* at an elevation of 207 feet above high water, this light is visible in clear weather for a distance of 21 miles.

Amrum harbour light is a *fixed white* light, visible through an arc of 90 degrees, and bearing E.S.E. distant 1,968 yards from the principal light; it is elevated 26 feet above high water, and in clear weather should be seen 6 miles. The lantern is on an iron hut.

This light in line with the principal light leads into the harbour, and will be exhibited as long as the navigation is not closed on account of ice.

At the entrance of Wyk harbour on the eastern side of Föhr island, two *fixed white* lights are shown from lanterns placed on poles at 19 and 15 feet respectively above high water, and visible 5 miles, and when in line they lead in. They are seen between the bearings S.W., through west, and North.

At Dagebüll there are two *fixed white* lights, 117 yards apart, E.S.E. and W.N.W., on the pier, one 24 feet and the other 19 feet above high water, visible from a distance of 9 miles. The lights in line lead into the harbour.

Buoys.—The buoyage of Schmal deep is in accordance with the German Uniform System. The leading buoy is a *black* and *red* beacon buoy, with *Schmaltief* on it, and surmounted by a double ball; within the leading buoy, the starboard side of the channel, entering from seaward, is marked by lettered *red* spar buoys, and the port side by numbered *black* conical buoys.

Directions.—To make Schmal deep, bring Seesand beacon to bear N.E. easterly, in which direction it shows southward of Amrum island, or Süderoog beacon E.S.E., and which will lead to the fairway buoy. In thick or hazy weather, it will be necessary to pay great attention to the soundings, and if the buoy is sighted before

the beacon, shape a course so as to bring the buoy in the above-mentioned direction before steering towards it.

Special care is required when passing Seesand, as here the tides set across the channel, after which the navigation of Norder Aue to Wyk presents no difficulty.

Amrum harbour, close inside the south point of Amrum, with a breadth of 400 to 600 feet, trends as far as Steen point. At the mouth of the inlet there is a bar, with 3 feet water, but across which there is a narrow gut with 7 feet, and inside 8 feet, until midway, where the depth is only 4 feet, and close to the shore, off the house at Steen point, only 2 feet water. The harbour affords shelter against all winds, as the shallows to the N.E. and East of it dry at half tide.

The lights in line lead into the harbour.

Wyk harbour in Norder Aue has a depth of 9 feet at ordinary high water; vessels lie on the ooze bottom at low water. The pole beacons by which the entrance is pointed out should be kept on the port hand when entering; and as the flood tide sweeps across the entrance, it is necessary in this case to keep close to the beacons; and during the ebb tide, to keep more to the northward to avoid being carried on the edges of the shallows.

In Wyk, vessels may be provided with necessaries; and as there are three very good ship-yards, with two slips, even large vessels may be repaired, but they must unload at the anchorage outside to lighten them sufficiently to enter the harbour.

Coal can be obtained at Wyk and is delivered in small vessels in the roadstead, also in Lister deep or Hornum.

Tides.—It is high water, full and change, at Wyk, Föhr island, at 1h. 50m., springs rise 8 feet; and at Amrum, at 0h. 20m., springs rise 9 feet.

Anchorage in Schmal deep.—Eastward of Seesand, with the house of Norderoog in one with Pellworm tower, a vessel may anchor in a convenient depth, according to draught, on a sandy bottom, sheltered against winds from South, round east, to N.E.

Close to the east side of Seesand, a little to the southward of its north-east spit, there is a tolerable anchorage in 6 or 7 fathoms, sand, sheltered against N.W. and N.N.W. winds, but it would be doubtful whether a vessel might be able to ride out a gale.

Off the south-east point of Amrum, the point bearing N. by W., there is shelter against winds from North to West, but not nearer to the edge of the shallow than in 3 fathoms, where the bottom is fine sand, and good holding ground.

Lifeboats.—There is a lifeboat stationed at Wyk, Föhr island; also one at Amrum island, on the east point of the island (White hill), at $1\frac{3}{4}$ miles from the lighthouse bearing N.W. by W. $\frac{3}{4}$ W.

Süder Aue turns easterly from Seesand, between the Schweinsrücken and Alte Jap shoals, past Knudshörn shoal, and between the islands Hooge and Nordmarsch, with a depth of 4 to 8 fathoms; further in, the channel leads between the islands Gröde and Habell on the north, and Beens and Hamburger halligs on the south side.

Anchorage.—There is good anchorage in from $3\frac{3}{4}$ to 7 fathoms, clay, near the shoal which extends off Hooge hallig with the mill bearing about S. by W. $\frac{3}{4}$ W.; there is also anchorage along the edge of the Knudshörn which is marked by pole beacons.

Old Schmal deep is eastward of Tusch gründe between it and the outermost of the extensive dry sands connected with Pellworm and Süderoog hallig. This inlet has about 11 feet water on its bar, and is of some consequence to the navigation between the Elbe and the west coast of Schleswig; it is commonly frequented by coasters, when the wind is south-westerly, more particularly as its course is direct N. by E. and S. by W., with a good breadth. The channel is subject to change.

The outer buoy is a *red* and *black* beacon buoy with an hour glass, and the name *Alt Schmaltief*; and the eastern side of the channel is marked by *red* buoys.

It is necessary to keep the lead quickly hove, as the depths diminish rapidly from 6 and 4 fathoms to 12 feet; when near the outer buoy steer about N. by E.; this course leads into Old Schmal deep.

AMRUM BANK lies in the offing 10 miles from the western point of Amrum island. The depths on it are from $3\frac{1}{2}$ to 5 fathoms. The south end of the bank in 5 fathoms, lies $14\frac{1}{2}$ miles W. by N. $\frac{3}{4}$ N. from Seesand beacon, and its north end lies 7 miles W. $\frac{1}{4}$ N. from Hörnum beacon.

During clear weather the sand-downs on the south end of Sylt island are visible, as also those along the west side of Amrum, among which the Saddledown, and further south the Grossedown, are conspicuous; Amrum lighthouse and mill may likewise be seen over the sand-downs.

The shallowest water of $3\frac{1}{2}$ fathoms, lies with Amrum lighthouse bearing E. by S., distant $12\frac{1}{2}$ miles.

VORTRAPP DEEP is entered over a bar, with about 12 feet on it at low water, formed by the shallows off Amrum island. The

channel is then along the inner side of the shallows extending southward from Hörnum, and into Hörnum harbour or road.

Both the bar and the channel are liable to change.

The continuation inwards of Vortrapp deep, from abreast Hörnum point, is Hörnum deep; it leads E.N.E., with a depth of about 6 to 8 fathoms, northward of Liin sand; from thence the channel inclines N.E. towards Föhrer Schalter, with a depth of 3 fathoms at 2 miles from the shore of Föhr.

Buoys.—The buoyage of Vortrapp deep is in accordance with the German Uniform System. The leading buoy is a *black* and *red* beacon buoy, with *Vortrapp Tief* on it, and surmounted by a ball. Within the leading buoy the channel is marked by lettered *red* spar buoys on the starboard side, entering from seaward, and by numbered *black* conical buoys on the port side.

Directions.—Those bound to Vortrapp deep should steer for Amrum lighthouse E.N.E., leaving the leading buoy on the starboard hand, whence alter course to N. $\frac{3}{4}$ E., taking care to allow for the tidal streams setting nearly abeam. Then steer by the buoys up Vortrapp deep in a clear channel of not less than $5\frac{1}{2}$ fathoms to Hörnum roadstead.

The best anchorage is in from 4 to 5 fathoms with Hörnum beacon bearing between N.W. $\frac{3}{4}$ W. and W.N.W., except in south-westerly gales which occasion a rough sea. With strong winds from East to S.E., vessels should moor north-west of Liin sand.

Caution.—In a gale, and the wind scant, this inlet should never be attempted by a sailing craft, for from the heavy sea and the tide, particularly with a north-west gale, it is impossible to come in or out without risking vessel and life. Under all circumstances the lead must be carefully attended to when approaching the bar, as the depths decrease suddenly from $3\frac{3}{4}$ fathoms to 2 fathoms.

Kniep haven.—Kniep sand is connected with the south-west side of Amrum; it is generally dry, and extends, with a narrow spit to the northward, along the island one mile to the northward of the west point. Inside this sand there is a small harbour, with 4 to 6 feet water, where boats and flat bottom craft shelter from all winds as long as the water does not rise over Kniep sand, which occurs only with westerly gales and extraordinary high spring tides; in some parts of this haven the bottom is rock and seaweed.

SYLT ISLAND.—From seaward, the northern point of Sylt island, appears low; but close southward of the point the hills rise to the height of 124 feet. From the northward, these hills appear

like three hummocks equidistant from each other, and are visible 12 miles. By these hills the island is easily distinguished from Röm, on which the tower of St. Clemens church is very conspicuous. The western shore consists of white sand-downs, except a single remarkable cliff named Red or Röthe kliff, nearly 7 miles southward of the lighthouses on the northern part of the island, and affords an excellent mark to make the land and Lister deep. It is not only the highest of the sand-downs on the coast (150 feet), but the whole of its lower part, rising perpendicularly from the sea, consists of a solid mass of dark hue, being a ferruginous coarse sand and clay, and of a different appearance from all the rest of the downs.

This remarkable cliff may be discerned at 12 to 16 miles, from a vessel in 9 to 10 fathoms; and during the forenoon, if the sun be not then shining, it has a dark hue, whereas in the afternoon it has a yellowish tint. Abreast the cliff, about 4 miles off, the bottom is reddish sand, therefore, during the night or in thick weather, and coming from the southward, when the soundings change to red sand, instead of fine sand more or less mixed with ooze, it shows that the vessel is in the vicinity of Röthe kliff.

From Hörnum point, shallows which dry at low water, and in some places even at half tide, project 8 miles in a S.W. $\frac{1}{2}$ S. direction; the breadths of these shallows in the middle is nearly 3 miles, the depth gradually increasing outward; they are named Thee knob, Hörnum sands, Holt knobs, and Jungnamen; between the two latter is a passage for small coasters into Vortrapp deep.

Beacons.—To distinguish Hörnum point from the uniform appearance of the adjacent coast, and also to warn seamen of the dangerous shoals which extend south-westward from it, a beacon is erected on a sand-down near the south point of Sylt island. The beacon is of a circular form, and its summit is 104 feet above high water; at its base there is a sheltered place for shipwrecked mariners, who will find benches on which they can repose, and cases containing bread and water. About one mile north-east of it, on another sand hill, is a smaller erection.

At the north end of the island there is a beacon 88 feet above high water on Albodal Ellenbogen sand-down; and another at List having the top like an hour glass.

Signal station.—There is a signal station situated at Ellenbogen connected by telegraph with the German telegraph system, vessels communicate by the International code.

LIGHTS.—Two lighthouses, each exhibiting a *fixed* light, stand on Albue head at the north end of Sylt island.

The lights are distinguished from each other by the outer or westernmost showing a small *red* sector towards the entrance, at an elevation of 63 feet above high water. The inner light is 72 feet above the same level, and visible from S.E. by E. $\frac{3}{4}$ E., through south, to N.N.E. In clear weather they may be seen at the respective distances of 10 and 12 miles; but when approaching from the southward, along the western shore of Sylt island, the inner light will occasionally be intercepted by the cliffs until the lights are nearly in line.

The lighthouses are circular, painted *white*, with *red* tops; the westernmost is 30 feet and the easternmost 41 feet in height; they are $1\frac{1}{2}$ miles apart, in a S.E. by E. $\frac{3}{4}$ E. and N.W. by W. $\frac{3}{4}$ W. direction, and when in line lead over the bar. *See* Caution, page 229.

Röthe kliff.—A lighthouse stands on Röthe kliff near Bröns hill, and Kampen village, so as to be visible over Röthe kliff; and is consequently a conspicuous object on the coast. It is a round, *yellow* tower, 123 feet high, and exhibits, at an elevation of 205 feet above high water, a *fixed white* light, varied every *fourth minute* by a bright *flash*, between the bearings N.N.E., through south, to W.S.W., and which in clear weather is visible 21 miles. In the direction of Lister deep, between the bearings S. by W. $\frac{3}{8}$ W. and S.W. by W., the light is faintly coloured *red*.

Munkmarsch.—A *fixed white* harbour light is exhibited at Munkmarsch on the east side of Sylt island, from the south side of the landing pier, the light is visible 5 miles in clear weather.

A *red* light of the same description is exhibited on the pier, but to the southward of the other. The two lights in line lead through the channel to the harbour. They are visible from S.S.W., through west, to N.W. $\frac{1}{4}$ N.

Lifeboats.—There are five lifeboat stations on Sylt island, respectively at Rantum; at Westerland; at Kampen, to the north of the lighthouse; at Albue head; and at the east point of List land.

Storm signals are shown at Keitum. *See* page 9.

RÖTHE KLIFF SAND lies in the offing between lat. $55^{\circ} 10' N.$ and $55^{\circ} 13' N.$, abreast the islands Manö and Röm. The general depth on it is 4 to 6 fathoms, with coarse, yellowish-brown sand on

the west side, but on the east side, where the shoalest parts are, fine sand of the same colour. Between its eastern side, and the outer shallows from the shore, the bottom is likewise fine yellow-brown sand, and as the depth is nearly the same, the bank may be considered as part of the shallow. On its south-west side the bank in some places slopes steeply, and the bottom outside it is dark sand, with ooze, frequently mixed with shells. Its shoalest part near the northern side, with a least depth of $3\frac{1}{2}$ fathoms, lies about 11 miles N. by W. $\frac{3}{4}$ W. from the north end of Sylt island.

RÖM ISLAND, north-east of Sylt island, and separated from it by Lister deep, is 7 miles long N.N.E. and S.S.W., and 2 miles wide.

Off the south-west side of Röm, Haff sand, the greater part of which is dry at ordinary high water, extends $1\frac{3}{4}$ miles towards Albue (Elbow) point, on Sylt. The outermost part of this shallow is a flat with less than 2 feet water, which slopes steeply into the deep; the southern part of the dry sand is marked by a *white* buoy D, lying in 21 feet, and beacon poles. Close outside Haff sand is Lamb shoal.

Rüst sand, outside Lamb shoal, lies 6 or 7 miles West and W. by S. from Röm, with irregular depths. The shoalest place on the Rüst is the south-west side of the shallow forming the northern side of Lister deep; it consists of hard sand, and has depths of $1\frac{1}{2}$ to 2 fathoms for 2 miles east and west.

To the southward of the above shoal is Salt sand, composed of very loose sand, extending nearly 3 miles, about W. by N. from Albue point, within the 3-fathoms line, and having 2 to 15 feet water over it. On the northern edge of the sand are the shoalest patches close to the deep, on which in stormy weather the sea breaks heavily.

LISTER DEEP is the safest and best marked channel between the Elbe and Horn reefs, it has about 16 feet over the bar; it is, however, liable to change.

The narrowest part within the bar, between Rüst sand and Salt sand, is one-third of a mile wide, and varying in depth from less than 4 fathoms to 8 fathoms near Salt sand, and to 15 fathoms near Haff sand. *See* Caution, page 229.

Tides.—It is high water full and change at Lister deep fairway buoy at 0h. 30m.; springs rise $5\frac{1}{2}$ feet. In the roads at 2h. 0m.; springs rise $6\frac{1}{2}$ feet.

LIGHTS.—*See* page 227.

Buoys.—The buoyage of Lister deep is in accordance with the German Uniform System. The leading buoy is a *red* and *black* beacon buoy, with *Lister Tief* on it, surmounted by an elliptical ball with a triangle point downwards above. Within the leading buoy the channel is marked by lettered *red* spar buoys on the star-board side, entering from seaward, and by numbered *black* conical buoys on the port side.

Caution.—With a scant or contrary wind it is necessary, whether inward or outward bound, to pay great attention to the setting of the tide, and during the ebb stream not to come too near Salt sand or the Rüst, as that stream sweeps obliquely across these shoals with great rapidity, but the flood runs from them on both sides of the channel; the rippling on their inner sides is visible, and during boisterous weather from the westward, the surf on the shoals indicates the channel. Further in, on the contrary, both flood and ebb run along the Albue shore, and there, as also midway in the deep, between the Rüst and Salt sand, it follows the direction of the channel.

As Lister bar is liable to alteration in position and depth, it is advisable, if practicable, for strangers to procure the services of a pilot.

Directions.—Coming from the southward, with the intention of entering Lister deep, the intervening sand-downs may prevent the lighthouses from being seen, therefore, keep well off the shoals in $5\frac{1}{2}$ to 7 fathoms, until so far advanced to the northward as to have the lighthouses visible and in one, bearing S.E. by E. $\frac{3}{4}$ E.; if the weather is sufficiently clear, Ballum church tower will then be seen, a little southward of the southernmost house in Röm. When Röthe lighthouse bears about S. by E. steer for the entrance with the upper light open a little to the southward or the lower. Pass on either side of the fairway buoy, and between the *black* and *red* buoys, and when on a S. by W. $\frac{1}{4}$ W. bearing of Röthe lighthouse, the shallowest part of the bar will have been passed and the deep entered.

On passing Albue point, the villages Morsum and Keitum will first be visible over Sandspierling point, then Braderup, and immediately after, the easternmost houses in Kampen village will open out, when haul to the southward, being then to the eastward of Barling sand, on which there are 20 feet water, and steer into List road, avoiding the shoal extending $2\frac{1}{2}$ cables N.E. by E. from the east extreme of Ellenbogen, marked by a *red* spar buoy in $4\frac{3}{4}$ fathoms. Large vessels should moor in the direction of the ebb and flood stream, about N.E. and S.W.

At night, having made Røthe kliff light do not go into less than 8 fathoms until Lister deep lights are in line. The eastern or *white* light, just open northward of the western or *red* light will lead over the bar in about 16 feet, when the light on Røthe kliff changes to *red* bearing S. by W. $\frac{1}{4}$ W. steer more easterly, and round Ellenbogen by the lead, and when the light on Røthe kliff (still *red*) bears S.W. $\frac{3}{4}$ W., steer for it to the south-westward and anchor in List road in 6 fathoms, sandy bottom.

Römer deep.—When in Lister deep, and List beacon is seen eastward of Ellenbogen, steer East until near Haff sand, which is steep-to; and then stand close along this sand, in from 5 to 8 fathoms and enter Römer deep, the sides of which are marked by the *red* buoys on the north edge of Jordsands flat and perches on Haff sand.

By following the sand between the perches and buoys, the course changes by degrees more northerly, until abreast the south end of Röm, where a vessel may anchor in $4\frac{1}{2}$ fathoms. Small craft may enter the bay or harbour, but they will be left dry at low water. The breadth of the channel up to the anchorage off the signal post is one-third of a mile, and the depth from 10 to 6 fathoms.

Höyer deep is between Jordsands flat and Hunnigen sand, with a depth of 6 to 10 fathoms; and on either side shallows, which are steep-to, until past the small island Jordsand. It is marked by buoys.

LIGHTS.—Two *fixed* lights are exhibited at Höyer, the northern *red*, from a post at Höyer water-gate, and the southern *white* from an iron structure at Friedrichen Koog, 1,094 yards from the northern. The lights are visible between the bearings N.N.E., through east, and S.S.E., from 5 to 7 miles, and kept in line will lead through the channel from Höyer deep to Höyer water-gate.

Lister ley.—This small inlet is a continuation to the southward of Lister deep, between Hunnigen sand, the north-west side of which is dry at half tide and remarkably steep-to from 10 fathoms, and Leghörn sand which is dry at low water and is connected with Sylt island. The depth in Lister ley is 5 to 7 fathoms, and it affords good anchorage and shelter from all winds.

Pander deep leads out of Lister ley between the Leghörn and Butter sands, with 4 to 5 fathoms for 2 miles up to its termination at about 2 miles from Munkmarsch; the landing place for the bathing establishment at Westerland.

JUVRER DEEP, 10 miles north of Lister deep, leads from the sea between Kore sands on the north side, and Römer flat on the south side, and branches off into two channels near the spit of Reisby shallow, where the inlet has a depth of 5 to 8 fathoms; but the bar on the outer shallows, on which there is a dangerous surf during westerly gales, renders it difficult to enter, more especially as it is not buoyed.

There is only one foot on the bar at low water, it leads to no ports and should only be used by those having local knowledge.

The boundary which separates Germany from Denmark is about half a mile southward of West Vedsted.

On Juvrer sand northward of Röm, two beacons mark the boundary between Danish and German waters in the North sea. The beacons stand East and West of each other; the Eastern beacon is a pole with a flat square head about 32 feet above the ground; the Western beacon is also a pole and shows square on all sides on the top at $25\frac{1}{2}$ feet above the ground.

In the vicinity of West Vedsted close to the coast, is a beacon 30 feet high, with a wooden tablet on the top. This beacon kept in line with the cathedral at Ribe marks the boundary line between the Danish and German waters from the eastern boundary beacon on Juvrer sand and in towards the land.

Draget inlet.—The inlet to Ribe, named Draget, leads from the sea, $1\frac{1}{2}$ miles north of Juvrer deep, between Yder Knude and Flakstjerten sands on the north side, and Kore sand on the south side, to Manö flat, along which it runs E. by N. $\frac{3}{4}$ N., and joins Knude deep between the easternmost spit of the Flakstjerten and the north-western spit of Manö flat; but as the depth in this channel is only 6 to 8 feet, it is only practicable to fishing vessels, and such as are intimate with the frequently changing shoals.

FANÖ.—The south end of Fanö is surrounded by the sand-banks Kilsand, Peter Meyers sand, Indre Knuden (the inner knot), and Gallge reef, all partly dry till high water.

Beacons.—On the sand-downs at Sönderho stand two pyramidal beacons, 1,000 yards E.N.E. and W.S.W. from each other, the northern is 47 feet in height, surmounted by a square with a triangular top and a vane above, and is 82 feet above the sea; the western beacon is also surmounted by a square, but a triangular notch is cut out in the upper part, it is 39 feet high, and 72 feet above the sea. See drawings on Admiralty chart, No. 1,887.

On the south side of Peter Meyers sand there are two smaller beacons with framework tops, 550 yards apart, E. $\frac{1}{2}$ S. and W. $\frac{1}{2}$ N., and each 30 feet high.

Fanö beacons on the north end of Fanö are 1,500 yards in an E. $\frac{1}{4}$ S. and W. $\frac{1}{4}$ N. direction from each other. The eastern, named Mill beacon, has two arms in the form of a St. Andrew's cross and is surmounted by a rectangular grating; the beacon is 60 feet high and is painted *red*. The western beacon is a mast with supports, having on the top a *red* square, facing the channel, with a *red* cross above and below; the beacon is 42 feet high.

Tides.—It is high water full and change at Sönderho at 2h. 22m.; springs rise $5\frac{1}{2}$ feet.

KNUDE DEEP.—This channel, which is liable to constant changes, and is buoyed according to the Danish system (*see* page 20), passes between Peter Meyers sand to the north and the Flakstjerten to the south, then between Kilsand, and Peelriff, and Laeggen. Do not approach the outer shallows within the depth of 4 fathoms, before Sönderho beacons are seen, which, brought in line E.N.E., is the leading mark until Meyers beacons are in one, E. $\frac{1}{2}$ S. The outer *black* buoy, with a ball, will then be seen.

Having passed the buoys, the course is about E. by S. easterly for Ribe cathedral, which is visible in clear weather, and conspicuous by its high and square tower, with a flat top.

For such vessels as are able to enter Knude deep, the channel affords good anchorage and shelter off Kilsand.

Ribe channel.—At the south-east point of Kilsand, Ribe channel branches E. $\frac{1}{2}$ S. from Knude deep, with a depth of 18 to 8 feet. The rivulet beyond only allows small craft drawing 3 to 4 feet to pass up to the town of Ribe, larger vessels being obliged to remain nearly 4 miles from the shore, and to unload or load by boats or prams.

GRAA DEEP, between Fanö and Skallingen, leads to the port at Esbjerg, and to the snug little harbour Fanö Lo, on the north-east side of Fanö; and northward to Hjerting, where vessels drawing 9 feet may lie afloat at low water; and still further to the northward to Varde rivulet, admitting small craft drawing 3 to 4 feet.

Esbjerg is opposite the north-east end of Fanö. It is formed by jetties, and is dredged to a depth of 12 feet at high water. Hjerting is the sea-port of Varde, and exports a great many cattle, and the produce of Jutland to England. A little to the northward of Hjerting

there is a wooden pier, 220 yards in length, at the outer end of which there are 11 feet at ordinary low water.

Pilots.—In fine weather a pilot may be obtained outside the bar of Graa deep, the pilot cutter is then either cruising in the bay, or lying at anchor near the whistle light-buoy. By night the pilot-signal is shown to approaching vessels. In bad weather, with onshore winds, pilots can only be obtained within the bar, their station being then eastward of Skallingen.

Depth on the bar.—The depth on the bar is about 10 feet at low water, and 15 to 16 feet at high water springs, but is much affected by the wind; westerly and south-westerly winds raise the level of the water, and easterly winds lower it, but with the latter the bar is always smooth.

Caution.—In consequence of the changing nature of the sands, strangers should not enter Graa deep without a pilot. The buoys are shifted as soon as possible to meet these changes.

Vessels are prohibited from anchoring on the line of the leading lights in Graa deep, or of those in the fairway to Esbjerg in line.

LIGHTS.—On Sædenstrand are two *fixed* leading lights for Graa deep, which can be seen through an arc of 9 degrees on either side of an E.N.E. bearing.

The Western lighthouse, 23 feet high, is *black* with *white* stripes, and the light is shown at an elevation of 41 feet above high water, and is visible for 11 miles in clear weather.

The Eastern lighthouse is an octagonal iron tower, painted *red* and *white*, and bears about E.N.E., distant 700 yards from the western one. The light is 86 feet above high water, and can be seen in clear weather for 15 miles.

A supplementary light, visible 11 miles, is shown from the low lighthouse; *white* from N. 36° E. to N. 9° W.; obscured from N. 9° W. to N. 12° W.; *red* from N. 12° W. to N. 45° W.

Esbjerg harbour leading lights are two *fixed white* lights, visible through an arc of 9 degrees on either side of a S.E. $\frac{1}{4}$ S. bearing. The northern light, which is 26 feet above high water, is shown from a *white* beacon on the north dock dike; the southern lighthouse on the eastern jetty is painted *red* and *white*, and 36 feet high. The lighthouses are 315 yards apart, S.E. $\frac{1}{4}$ S. and N.W. $\frac{1}{4}$ N.

Two *fixed red* lights on the north mole seen in line mark the northern limit of the harbour. A *fixed white* and *green* light is shown from a *white* beacon on the South mole head; *green* from N. 21° E., through east, to S. 20° W., and also from N. 32° W. to

N. 49° W.; *white* from N. 21° E., through north, to N. 32° W.; obscured in other directions.

A *fixed red* light is shown on each of the outer angles of the Lockgate.

Fog signal.—When the fog signal of an approaching vessel is heard, a bell on the North mole head at Esbjerg is sounded *every two minutes*.

Nordby.—Two *fixed white* lights shown near Rindby, lead through Fanø Lo, and a *fixed red* and *white* light is shown on the pier head. A *green, red, and white* light is shown on Pakhus point.

Beacons and buoys.—Besides the two beacons on the north end of Fanø island, already mentioned, page 232, there are two others on the south-east point of the Skallingen; the south-west beacon is a large white mast with supports, 28 feet high; the north-east beacon 700 yards E.N.E. from the former, it is a mast 32 feet high, painted with *red* and *white* horizontal bands, having a diamond top.

A conical, *black*, automatic whistle buoy, exhibiting a *fixed white* gas light, is moored outside the bar of Graa deep, southward of the line of the Sædingstrand leading lights in line. A bell buoy is moored outside the bar, northward of the line of the leading lights in line; also a beacon with three up-turned brooms. A light-buoy is moored within the bar.

The channel to Esbjerg is marked by *black* buoys and beacons on the starboard hand, entering from seaward, and by *white* buoys and beacons on the port hand. A white perch is placed on the east extreme of the leading-mole.

Tides.—It is high water, full and change, on the bar of Graa deep about 1h. 15m., and at Esbjerg at 2h. 32m.; springs rise 5 feet.

Outside the bar the flood stream sets S.S.E. and the ebb stream N.W.; within the bar the flood stream runs until the time of high water at Esbjerg, and sets N.E. towards the end of the tide; the ebb, until about two hours after high water, runs with the channel; during the next two hours it sets in a westerly direction, and for the remainder of the tide runs S.W. over the bar, turning to the southward with the first of the flood stream outside. The ebb stream runs over the bar for some time after low water there.

Directions.—The land about Graa deep is low; approaching the bar, Fano mill will probably be the first object seen, and in clear weather, Jørne and Esbjerg churches. Seamen should endeavour to keep southward of the bar until their position is ascertained, and attention should be given to the lead, and the set of the streams. To cross the bar, bring the lights at Sædenstrand in line, bearing about E.N.E., and steer in with them in line, passing between the

whistle light-buoy and the bell-buoy on the bar, and leaving the light-buoy within the bar, and the *black* buoys, on the starboard hand; and the *white* buoys on the port hand. Keep the Sædenstrand lights in line until Esbjerg *white* lights are nearly in line, turning into the line of those lights in line gradually, and leaving the *white* buoy on Lilho sand on the port hand.

Esbjerg lights in line lead close to the edge of the bank northward of Fanö. An auxiliary light, *fired white*, is shown from the front Sædenstrand lighthouse in a southerly direction. Esbjerg lights should be kept in line until the vessel is near the eastern limit of the auxiliary Sædenstrand light, when course should be altered to the southward, keeping just on the eastern limit of the auxiliary light, until past the line of the *red* lights on the north mole of Esbjerg in line, when course may be altered towards the harbour or the anchorage.

When approaching Graa deep from the southward at night, Røthe kliff light should be made.

Hjerting channel is marked by buoys and beacons; the depth is from 3 to 5 fathoms, both sides being steep-to, particularly at the Topsand. Half a mile southward of Hjerting a ridge of sand, extending from thence to abreast Hjerting, divides the inlet into two narrow channels, each of which is 138 yards wide. On this ridge there are 7 feet, but on its north-east spit only 6 feet. The best anchorage is northward of the ridge, where there is a breadth of nearly $1\frac{1}{2}$ cables across the channel, in 9 to 12 feet, sand and ooze, sheltered from all winds, except those from south and south-west, which during the ebb tide cause some sea.

Fanö Lo.—In this harbour the bottom is ooze, and there are 4 feet at low water abreast the ferry house.

The lights near Rindby about one mile southward of Nordby kept in line lead through Fanö Lo.

Lifeboat.—There is a lifeboat and rocket apparatus stationed to the southward of Nordby and a lifeboat near Sönderho on Fanö island.

Telegraphs.—There is telegraphic communication between Strandby and Fanö, the direction of the cable is marked by one *red* and *white*, and one *white* beacon, set up near the old Ferry house, S.W. by W. $\frac{1}{4}$ W. and N.E. by E. $\frac{1}{4}$ E. of each other. There is another station about half a mile S.W. $\frac{1}{2}$ S. of the most southern mill at Nordby. This cable is laid out in a W. by S. $\frac{1}{2}$ S. direction and is connected with Calais.

HORN REEFS.—The outer 5-fathoms line of soundings around these dangerous reefs is about 20 miles W.N.W. from Blaavand point; thence to the southward for about 8 miles, then curves south-eastward for about the same distance to the south extreme of the reef, at about 11 miles S.W. by W. from the point, when it trends E.N.E. for 8 miles and round the reef forming the western boundary of the Slugen or Gullet. The reefs consist of several banks, on the shoalest part of which there are 2 feet at low water.

The Outer reef is an extensive irregular bank, with 2 to 4 fathoms, except on certain patches, which have depths varying from 9 to 15 feet on them.

Lifeboat.—There is a lifeboat and rocket apparatus at Blaavand point.

Directions.—When approaching Horn reefs from the northward, keep in 18 fathoms to pass outside the reefs, near which there are 12 to 15 fathoms. By day, bearings of Blaabjerg and Horn reef light-vessel will give the position. The nature of the bottom is important; if mixed with transparent white pebbles, the vessel will be close westward or southward of the reefs, and ought not to stand in to shoaler water. Particular attention should be paid to the direction of the tidal streams or the current (pages 12 and 239), if bound for Fanö, do not incline more southward and eastward than to be in 10 fathoms on rounding the outer edges of the reefs.

To pass outside the reefs when coming from the southward, the vessel's position should be ascertained by bearings of the islands, particularly of Fanö, the southern end of which may be known by its two beacons, the northern one being the higher (page 232). Further to the northward, the beacons on the north end of the island will be seen, together with Fanö mills, and also with Jørne church in Jutland, standing on an elevated position, which in clear weather may be seen over Fanö island, 16 miles, in the vicinity of Cancer shoal. Take care to allow for the set of the tide, and do not approach the southern edge of the reefs in less than the depth of 10 fathoms, nor than 7 fathoms when rounding their north-western edge.

The light-vessels are the best guide for clearing Horn reefs.

Slugen or Gullet.—The southern entrance to this channel is about $6\frac{1}{2}$ miles N.W. from the fairway buoy of Graa deep and those desirous of passing inside Horn reefs, should bear in mind that there are two channels divided by the inner reef. The West Sluge, or Norman deep, is formed by three patches on the south, viz.; the

Cancer, with 12 feet on it; the Munk, with 9 feet; lying between S.W. and West, and between 5 and 6 miles from Blaavand point, with the outer reefs to the westward; and by Ulv spit and Sören Bovbjerg knob, the latter with 2 to 12 feet over it, on the north. Ulv spit shoals gradually, and may be approached by the lead.

Ringkjöbing deep is formed by Sören Bovbjerg knob and by the shoals from Blaavand point. The shoals from Blaavand point extend 2 miles westward, and sweep round to the southward, terminating in a spit named Ulv (Wolf), which extends S.W. by W. $\frac{1}{2}$ W. for $3\frac{1}{2}$ miles, to 3 fathoms.

As the shoals are liable to change, particular attention to the lead is necessary when navigating these channels.

Buoys.—Near the west extreme of Horn reefs a *black* buoy with *white* staff and two brooms is moored in 5 fathoms. The name *Horn Reefs* is painted in *white* letters on the buoy.

A conical buoy, with a staff and broom and painted *red*, is moored in 8 fathoms, half a mile S.S.W. from the western end of Vyl shoal.

On the south side of Norman deep (West Sluge), and Slugen (the Gullet), which is the main channel through Horn reefs, are the following buoys.

To the eastward of the Munk, in 5 fathoms, a *black* buoy with staff and two down-turned brooms; and north-east of Cancer shoal, in $5\frac{1}{4}$ fathoms, immediately eastward of a 17 feet shoal, a *black* buoy with staff and one down-turned broom.

On the north side of the main channel, 4 miles north-westward of Sören Bovbjergs knob, a *white* buoy with staff and ball in 4 fathoms; south of the southern extremity of the same shoal a *white* and *black* striped buoy with staff and three upturned brooms, in $3\frac{1}{2}$ fathoms.

A can buoy, painted *black* and *white* in vertical stripes, surmounted by a *white* staff and two down-turned brooms, is moored in a depth of 4 fathoms, on the north-east side of Sören Bovbjergs knob.

LIGHT-VESSELS.—Horn reefs light-vessel lies off the western end of the reefs in 18 fathoms, showing at 31 feet above the sea a *flashing* light every thirty seconds, visible 10 miles. The light-vessel is painted *red* with a *white* cross, and has two masts, with ball at the masthead.

Fog signal.—From Horn reefs light-vessel a siren gives one blast of five seconds duration every two minutes.

Vyl light-vessel is moored on the south-west side of Vyl shoal at the south extreme of Horn reefs in 12 fathoms with Vyl buoy bearing N.E. by E. $\frac{1}{2}$ E., distant 4 miles. This vessel has one large mast amidships surmounted by two cones, painted *red*, with

their points together ; carries also a jigger mast, and is painted *red* with a *white* cross and with the name *Vyl*.

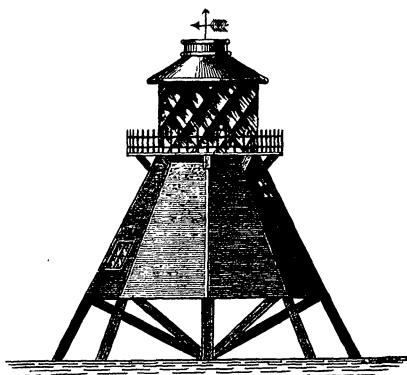
From the principal mast a *double flashing white light* is exhibited every *thirty seconds* in the following manner—a *flash of two and a half seconds* duration, an *eclipse of five seconds* ; a *flash of two and a half seconds* duration followed by an *eclipse of twenty seconds*.

The light is elevated 30 feet above the sea, and is visible in clear weather 10 miles.

From the forestay a riding light is shown.

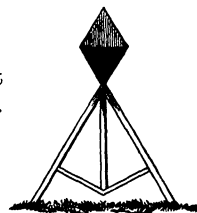
Fog signal.—From Vyl light-vessel a siren is sounded during thick or foggy weather which gives a *double blast every two minutes*.

BLAAVAND POINT LIGHT.—From the beacon on Blaavand point at an elevation of 91 feet above high water an *occulting white* light is visible between the bearings S. 32° W. through south to N. 36° W. as follows : between the bearings N. 36° W. to N. 20° W., N. 35° E. to N. 59° E., N. 80° E. to S. 71° E., S. 21° W. to S. 32° W. the light is visible for periods of *three and one-third seconds* duration separated by eclipses of *one second*, every *sixth* eclipse being lengthened to *five seconds*. Between the bearings N. 20° W. to N. 35° E., N. 59° E. to N. 80° E., S. 71° E. to S. 21° W., the light is visible for periods of *twenty-five seconds* duration separated by eclipses of *five seconds*. It should be seen in clear weather 15 miles.



Appearance of Blaavand beacon and lantern.

Beacon.—A wooden beacon painted *red*, about 50 feet high, is placed on the summit of Ringebjerg.



Ringebjerg.

BLAABJERG, 200 feet high, about $12\frac{1}{2}$ miles northward of Blaavand point, is an important landmark in this vicinity. It is the highest part of the coast, and when seen from the southward appears with three hummocks, and from the northward like the roof of a large house.

Tides.—It is high water, full and change, at Blaavand point, at 1h. 44m. ; but outside on the reef it is said to be at noon. The mean spring rise is 7 feet, and neaps 5 feet ; but it is greatly influenced by the state of the weather ; thus, gales from seaward produce a higher tide, and the contrary when they blow off shore. On Horn reefs, and to the northward and southward, between Nyminde Gab and Skallingen peninsula a regular tide exists, changing every six hours, though much influenced by the direction and force of the wind.

With gales from N.W. and North, the stream of flood runs longer and with greater velocity, and this with S.E. and South gales, is likewise the case with the ebb. The flood runs to the southward, and the ebb to the northward, through the channels across the reef, and generally at the rate of one or $1\frac{1}{2}$ knots. The stream follows the trend of the shore, and accordingly to the southward of Blaavand point the flood runs S.S.E. and the ebb N.N.W.

CHAPTER VIII.

HORN REEFS TO THE SKAW OR SKAGEN.

VARIATION 13° West in 1892.

Decreasing about 8' annually.

The coast between Blaavand point and the Skaw is without harbours or refuges. Along the coast a bank extends, consisting partly of three ridges, but between Blaavand point and Hanstholm, of two, and in some places of only one ridge, all of very compact sand, with occasional stones, and lying parallel to the coast, at nearly equal distances from it and from each other. The few shipping places there, are chosen in the least hazardous parts, where the distance of the ridges from the coast, and from each other, together with the depth over the ridges, make embarkation practicable.*

The outer ridge is in general distant 3 to 4 cables from the beach, commonly with a depth of 18 feet over it; the next ridge, with 11 to 12 feet, is a half to one cable's length inside the former, and between them there is a depth of 4 fathoms, and even more.

The flat-bottomed vessel, commonly used on this coast, is named a Skudder (a kind of smack). During the summer season these skudders anchor inside the ridges, and are hauled on shore when boisterous weather renders it necessary.

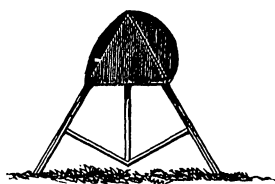
The shore between Ringkiöbing and Nissum fiords is of moderate height, and the churches are low, except that of Husby; all of them have low turrets, and are difficult to distinguish on account of the sand-downs along the beach. The churches on Holmsland, in the north end of Ringkiöbing fiord, have small pyramidal towers.

* See Admiralty charts :—North sea, No. 2,182*b*; scale, $m = 0.1$ of an inch; Baltic sea, No. 2,842*a*; scale, $m = 0.1$ of an inch; also Liim fiord, No. 2,325; scale, $m = 0.6$ of an inch.

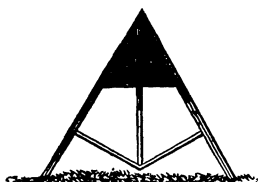
Among the objects on the sand-downs of Nyminde land is, on account of its form, the remarkable Lille Olesbjerg, in lat. $55^{\circ} 59' N.$, having a wide cleft, in the middle of which there is a small knoll; 7 miles further south is the large farmhouse of Bjerregaard, which in clear weather is visible 8 miles, and is therefore useful as a landmark in making Nyminde Gab.

But a still more important landmark for this part of the coast is Blaabjerg before mentioned, 200 feet high, and southward of Nyminde Gab. From the north or north-west of the hill, it has the appearance of the upper part of the roof of a large house. From the westward it appears of some length, highest in the middle, with many hillocks on its southern part, and is more conspicuous at a distance than when near it; from the south-west it appears of an oblong form, with a pointed hillock on its highest part. When seen from a more southerly position it is visible above all the sand-downs, being the highest part of the coast, with three hummocks on its top inclining to the westward; but the hill has no bluish hue, as might be presumed from its name, Blaabjerg (blue mountain).

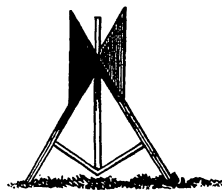
Beacons.—Wooden beacons, painted *red*, and from 40 to 50 feet in height have been placed on the summits of downs close to the coast, at the following places :—



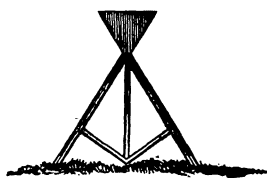
Kjærgaarde.



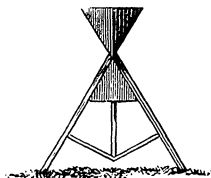
Haurvig.



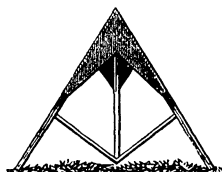
Aargab.



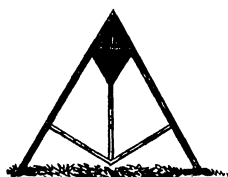
Klegod.



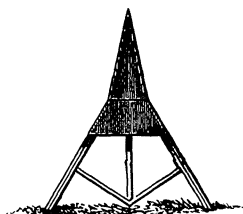
Husby Klit.



Vødersö.



Bjergehuse.



Thybo Rön.

Lifeboats.—Along the west coast of Jutland, where, from the want of harbours or places of refuge, so many vessels are shipwrecked, lifeboats with rocket apparatus, or separately, have been established at short intervals. *See* page 30.

Ringkiöbing fiord is an extensive lake separated from the North sea by a long narrow sandy ridge named Nyminde land, 16 to 20 miles in extent, which has been broken through at different times.

The navigation in this fiord is so tortuous and intricate, that local knowledge is necessary, though the different channels are marked out by poles. Nyminde Gab, the entrance to this fiord, has shifted considerably to the southward of late years.

The bar is distant about 3 cables from the beach, and the usual depth is $5\frac{1}{2}$ feet on its shoalest part; the leading mark for the inlet is the beacons in line, and small buoys mark the channel.

The water shoals gradually, and the seaman may stand in, by the lead, according to the weather; the stream is not too strong for a vessel to stem, when favoured by a gentle breeze.

Tides.—It is high water, full and change, in Nyminde Gab at 2h. 45m.; the average rise is about $2\frac{1}{2}$ feet. Westerly winds cause a greater rise, and with a succession of gales from that quarter a current is continually running in; the contrary is the case when easterly winds prevail.

Telegraph.—A telegraph cable connects Sondervig near Ringkiöbing with Newbiggin on the north-east of England.

The COAST southward of Fialtring is low, with sand-downs; Nissum fiord is only separated from the sea by a narrow, low, sandy, ridge of land. From Fialtring to 10 miles northward at Harboøre the shore is fertile and of moderate height, with no sand-downs. The most conspicuous part of the coast is Bovbjerg, 197 feet high, easily distinguished by a pillar on its summit, and by its being so steep towards the sea as to be excavated by it.

The low neck of sandy downs which separates the North sea from Liim fiord stretches about 9 miles southward of Agger; and, owing to the refraction, the waters of the fiord are sometimes visible from a considerable distance seaward, while the low land of the coast is yet below the horizon.

BOVBJERG LIGHT.—On Bovbjerg at about 12 miles South of Thybo Rön is a *red* brick tower, 84 feet high, from which is exhibited, at an elevation of 202 feet above high water, a *fixed white* light, visible in clear weather from a distance of 20 miles.

Nissum fiord.—The entrance to Nissum fiord is pointed out from seaward by Bøvling church, with a steeple somewhat like that of a mosque, to the northward of the entrance, while to the southward of it stands Husby church, with a steeple and pyramidal gable. The houses on this neck of land northward of Thors Minde and further in along the shores of the fiord, are the dwellings of North sea fishermen.

LIIM FIORD, an extensive lake of an irregular figure, insulates the northern portion of Jutland. On its banks lie the towns Lemvig, Nykiöbing, Lögstör, Nibe, Aalborg, and which by means of the navigation opened between the North sea and the Kattegat, partake of the advantage of sea-borne commerce. None but those who have local knowledge should navigate the fiord without a pilot.*

Comparisons with former surveys lead to the supposition that Liim fiord, in general, has decreased about 3 feet in depth during the last 160 years.

Thybo Rön.—Agger channel, formerly the entrance to Liim fiord from the North sea, was formed in 1825 by the sea bursting through the isthmus; this channel closed in 1868, and one opened, near Thybo Rön, about $2\frac{1}{2}$ miles south.

Caution.—Rön channel is constantly changing, and the buoys and beacons are moved as necessary; no vessel should attempt to enter without a pilot.

Ice.—In 1889, the steam-vessel from Aalborg was unable to reach Thisted on 9th February owing to obstruction by ice.

Navigable depths.—A vessel of 10 feet draught can navigate the channel from sea (Thybo Rön) to Lemvig. The heaviest draught vessel that has visited this port was of 9 feet draught (1890).

A vessel of 7 feet draught can navigate the channel from sea to Thisted, entering Liim fiord from the eastward, and of 10 feet draught entering from the westward (Thybo Rön). The heaviest draught vessel that has visited the port was of 10 feet draught (1890).

Thus, a vessel of 7 feet draught could navigate Liim fiord from the North sea to the Kattegat.

Buoy.—A *black* buoy with *white* staff and two brooms, and the words *Thybo Rön Canal* in *white* letters, is moored about one mile west of Thybo Rön channel entrance.

Light-vessel.—At the inner part of Rön channel, a light-vessel, painted *black*, is moored (ice permitting), which exhibits a *fixed red*

* See Admiralty plan :—Liim fiord, No. 2,325; scale, $m = 0.6$ of an inch.
SO 11863 Q 2

light from a height of 31 feet, which in clear weather is visible 6 miles, from 20th March to 15th of November.

Beacon.—A wooden beacon, painted *red*, about 50 feet high, with a long pointed top is placed at Thybo Rön. A rocket apparatus is maintained here. *See* page 241.

Pilots are stationed on board the light-vessel ; and provided that it is possible to pass through the surf, a pilot attends when the signal is made.

Tides.—Outside the mouth of the fiord the ebb runs S.W., and the flood North and N.E., being quite contrary to its direction further out. During settled weather there is a regular tide in the mouth of the fiord, but, when an easterly wind sets in after a continuance of westerly gales, the ebb may run out for a couple of successive days, until the common water-level is settled, when the tide again makes regularly and changes every 6 hours. The contrary is the case when westerly winds set in after a continuance of easterly ones. During a gale the stream may attain a velocity of 8 knots. It is high water, full and change, at 4h. 9m. a.m. ; and the rise is 2 to 3 feet.

Tidal signals.—A blue flag hoisted on the top of the beacon indicates that a vessel cannot enter Rön channel, either because the depth in the channel is less than 4 feet, or that the wind is too strong.

A red flag is hoisted on the low beacon as soon as the flood-stream begins to run into Rön channel, usually about 3 hours before high water, and is shown as long as the stream is running into that channel.

A frame hoisted on the yard indicates a depth of 5 feet on the bar ; each additional foot being indicated by an additional frame, and each half-foot by a frame hoisted half way up ; five frames indicate a depth of 9 feet and upwards on the bar.

Nissum bredning (broad).—Southward of the narrows there are 11 to 26 feet water in Nissum bredning and Lemvig. The bank along the west side of the bredning dries and is steep-to from 10 feet. The shore along the eastern side may be approached by the lead, but do not stand too near, abreast Helligsö and Katterup, on account of some large rocks lying from one to 2 cables off.

Near the inlet to the small town of Lemvig, there are some dangerous shoals, of which the north-easternmost, the Rönnen, consists of sand and rocks, with its south end barely covered. It lies $1\frac{1}{4}$ miles eastward from Geller point, and is beacons.

A beacon buoy marks the south-east point of a small shoal with only 6 feet water on it, three-quarters of a mile N.E. $\frac{3}{4}$ N. from Geller point.

Lemvig.—Anchor abreast of the town in 9 feet, soft bottom with seaweed, at one to 2 cables from the beach.

A *fixed white* light, visible 10 miles is shown from Sögaard when steamers are due, and another on Vinkel hage.

Odde sound.—Along the shore off Nissum the bank is steep with 9 to 12 feet water close to the beach; but on account of some small rocky patches with 6 to 7 feet water, outside the bank, when working along shore, do not go nearer than to have Hygum church in one with Nissum point. The depth in the sound is 5 to 9 fathoms, and the banks are steep-to, particularly on the south side at Grisetaa point, which may be rounded closely.

Venö sound.—From Odde sound a vessel may proceed through Venö sound westward of Venö, to the shipping-place Struér. The depth in Venö sound is 3 fathoms, and the shore is clean on both sides so as to be approached by the lead, except on the flat from the north-west point of Venö island, which is rocky.

The anchorage at Struer is one to 2 cables from the beach in 9 to 11 feet. The port has been excavated to a depth of 8 feet, and a new port has been dredged out to the eastward of the old one and double its dimensions.

Venö bay.—Close westward of the rivulet, off Handbjerg, vessels anchor in 2 fathoms, at 2 cables from the shore; but north and north-westerly winds, blowing right on, produce rather a rough sea. When entering Venö bay from the northward, and passing eastward of the island, avoid a sandy neck extending half a mile from Bradser point. Along the east side from Kaas head and to the southward of it, there are rocks near the beach.

Jegindtap spit.—Those passing to the south-eastward of Jegindö should avoid the spit (which has a beacon on it), extending from Jegindtap point, which is rocky and steep-to on its south-east side. The mark to clear the south end of this spit in 10 feet is Nörre Nissum church just open of Loubjerg point.

Næs sound.—In the middle of the southern part of Næs sound there is a small detached shoal, with large rocks on its south end, with only 4 feet water. From this shoal keep in mid-channel in the sound, until Bodum church and mill are in line, bearing S.W. $\frac{1}{2}$ S., which kept in line astern is the leading mark through the sound,

clear of Futterup point, and across Visby bredning, between the neck of sand extending from Maager point and a detached shoal off it.

Visby bredning.—The shore consists of sand, and shoals gradually towards either side. In the northern part is the shoal, above mentioned, lying five-sixths of a mile W.N.W. from Maager point, having 5 feet on its shoalest part.

With Bodum church and mill in line, a vessel will pass to the eastward of the shoal, midway between it and the shoal extending from Maager point.

The mid-channel course through Vil sound is about N.E. $\frac{1}{2}$ E. until past Örhole point, when steer more northerly through the narrows of the sound; the deep-water channel lies close along Ferry point on the east side. The depth in Vil sound is from 4 to 9 fathoms, and both sides are steep-to.

Thisted bredning.—The depth in this bredning varies from 3 to 7 fathoms, but is deepest in its western part in the direction of Vil sound. The shore may be approached by the lead, except off a neck of sand with 6 feet water and steep-to, extending N.W. from Skarre point in Morsö. Keep Overgaard, a farm in Morsö, well open of the point on the south shore, westward of Salgierhöi; the house of Overgaard may be known by an adjacent windmill, the only one visible on this part of the island. In a small bay abreast Gulderup there is anchorage in 12 feet, at one to 2 cables from the beach.

Thisted harbour is formed by a mole stretching E.S.E. and N.E. from the beach at the south end of the town. Close outside the mouth of the harbour, which is 34 feet wide, there are 10 to 12 feet, chalk bottom. Two pilots reside at Thisted.

LIGHTS.—At the south pier, Thisted, there is a small *fixed red* light, exhibited on a pole, and which is visible 4 miles.

There is also a *fixed green* light at the harbour office; these in line lead into the harbour. At the East mole a *fixed green* light is exhibited.

Fegge sound, uniting Thisted and Lögstör brednings, is in its narrowest part, between Fegge cliff and Sæbesholm, only two-thirds of a cable wide, with a depth of 4 to 10 fathoms, and the banks along either side are steep-to.

On approaching Fegge sound from the eastward, avoid a rocky spit extending $1\frac{1}{2}$ miles S.S.W. from Holm Tunge, with 3 to 8 feet water, and called Holm Tunge hage, which is passed in 10 feet water by

keeping the southernmost point of Fegge cliff well open of the north end of the hillock at Skaregaard in Morsö. When coasting along the east side of Morsö, and bound for Fegge sound, be careful to avoid a reef, with 3 to 6 feet, extending in an easterly direction from Fegge Rön.

When steamers are due a *fixed white* light, visible 10 miles, is shown on the heights at Han næs, and *red* and *green* lights at Fegge Rön and Fegge cliff.

Lögstör bredning carries $3\frac{1}{2}$ to $4\frac{1}{2}$ fathoms, with soft bottom, gradually shoaling northwards towards Bygholms Veile, and to the eastward towards Lögstör bar, which consists of sand. Between Lögstör and Livö brednings there are several shoals; on the northernmost is the Rön, a small islet, distant one mile from the beach abreast Eierslev hillock in Morsö, and separated from that island by a passage with $3\frac{1}{2}$ fathoms. The north side of the Rön is steep-to, but from its south end the rocky reef extends more than one mile to the southward, having on it 3 to 5 feet water.

At $1\frac{1}{3}$ miles East from the Rön, there is a sand-bank with 8 feet water on its shoalest part. Another shoal, the Blinde Rön, has a knoll consisting of sand and stones, dry at low water; this patch lies between the north-west point of Livö and Eierslev cliff, distant $1\frac{1}{2}$ miles from Livö. This shoal has 2 fathoms close to its south side, but off its north end a reef extends $1\frac{2}{3}$ miles to the northward, with only 3 to 8 feet water, at fully one mile from the dry spot.

Lights.—There are two *fixed red* and two *fixed white* lights at Nykiöbing, also a *fixed white* light on Or point.

Kaas bredning has a depth of $3\frac{1}{2}$ to 4 fathoms; the shoal along shore from Hester point to Sillerslev point is of small extent and consists of sand, but along the south side, round the point abreast of Kaas wood, it extends half a mile. Around the point it is rocky, but to the eastward, in the bay abreast Aalbæk mill, is a clean sandy bottom, with anchorage on the flat in 12 feet, at 2 cables from the beach. Vessels do not ride safely with gales from N.E. round by north to N.W.

Between Aalbæk mill and Ny (New) mill, the shore shelves suddenly, with rocks near the beach under the high land; but off Ny mill there is a clean sandy flat with anchorage in 7 to 9 feet water. Harre Vig is clean, with a depth of 3 to $2\frac{1}{2}$ fathoms in the innermost part of the creek.

Salling sound has from 6 to 10 fathoms, and northward of Glyngör point the depth is more than 16 fathoms. The shore is

steep-to on either side. However, when working, attention should be paid to avoid the rocky shoal from Vil point, close to the northward of Harre Vig.

A harbour is formed near Glyngör point for the steam ferry boats which go from there to Nykiöbing.

With winds from S.E. round by east to north the current generally runs to the southward, whereas, it runs to the northward through the sound with the winds from south round west to N.W., and is frequently too strong to allow a vessel to work through.

Draaby vig, on the east side of Morsö, affords good anchorage, sheltered against all winds except those from south, which raise a sea in the bay. When making this anchorage from the eastward, avoid a spit of sand with 3 to 4 feet water, which extends southward for half a mile from Buxer point.

Fuur island.—Along the north side of Fuur island there are from 2 to 4 fathoms, at 3 to 4 cables from the beach, close to which there are large rocks; so that vessels turning through the Livö bredning should not stand into less than 2 fathoms. On the shallow round Knuds head there are likewise some large rocks, which are cleared to the westward by keeping North Arup church just open to the eastward of Fegge cliff. In the small bay on the east side of the island, between Færker and Engelst points, is a clean sandy bottom and a gradually shelving bank, on which vessels may anchor and be well sheltered against winds from North round by west to S.S.E.

The south-west side of the island is steep-to towards Fuur sound. The best anchorage off this island is in Pulse Vig, the small bay on the south side of the island between Degen point and the mill, at one to 2 cables from the beach, in 12 feet water, sand and soft bottom.

In the easternmost part of Fuur sound, mid-channel, and half a mile eastward of the mill, there is the Middel ground, a reef nearly dry, with rocks on its west end, and steep-to, with shallow water to the eastward of it. This reef has a beacon on each end. The passage between Fuur island and Livö is named Favne deep, and has all through $4\frac{1}{2}$ to 6 fathoms.

Livö.—A bank along the west side of Livö extends half a mile and gradually slopes to deeper water on the north side; off the cliff on the west side of the island there are rocks near the beach. From the east side the bank is narrow and steep-to; and in a small bay there is anchorage in 9 to 12 feet, stiff ground, at one to 2 cables

from the beach, with Öslös church on with the easternmost point of the island.

At the south end of the island, from the end of the long and narrow spit, named Liv Tap, consisting of sand and pebbles, and dry at low water, a curved reef with a broom beacon on its extremity extends S.S.W. to S.S.E., with one to 2 feet water. To the eastward of Livö there is a clear passage, with 4 fathoms, and the bank from the east side of the island is steep-to, with rocks near the beach.

Biornsholm bay.—In this bay there is anchorage on the flat, abreast of the house and of the rivulet, in 9 to 12 feet, sandy bottom. Northward of Trend mill a reef borders the shore; and there are some rocks near the beach round Ertbölle point.

Riisgaard bredning carries 4 to 8 fathoms water, soft bottom. Off the north side of Rotholmene, in the southern part of the bredning, a reef, with one to 5 feet water, extends two-thirds of a mile N.N.W. and is steep on both sides. It is marked by beacons. Sundsöre hage projects half a mile in a S.E. direction from the ferry-house, and is steep-to, having a depth of 6 fathoms close to the spit, on which there is a broom beacon, and but 4 feet water.

In mid-channel into Hvalp sound, there are from 5 to 7 fathoms; the banks on either side being steep-to. The anchorage off Eskiaer is abreast of the mill stream or rivulet, at one cable from the beach, in from 9 to 12 feet. On both sides of Sundsöre hage vessels may anchor according to the direction of the wind in 12 to 15 feet, close to the beach. On the flat to the southward of the Riisgaard farms there is an anchorage in 12 feet, sandy bottom, at 2 cables from the beach.

Skive fiord.—Having passed Eskiaer wood, steer into Skive fiord, round Grønning hage. In order to avoid the spit off Lunde hage, on the outer extremity of which there is a beacon, a very conspicuous hill near the beach, S.E. from Tise church, should be brought in one with the outermost point of Grønning hage, this being the leading mark into Skive fiord, until near Krabbesholm wood, when the course is along the bank from the shore until at some distance to the southward of Krabbesholm; when a vessel may anchor at $1\frac{1}{2}$ cables from the beach, in 6 to 7 feet, soft bottom, abreast a small pier. On the bar of the river there is only $2\frac{1}{2}$ feet water, and within it from 4 to 6 feet up to Skive village.

Launs bredning.—From Jelse point a spit of sand, barely covered, projects 3 cables to the northward; its extremity falling

suddenly from one foot to 3 fathoms. A flat-topped hill in Nørgaard fields brought in one with the woody point near them, clears the spit which is marked by a beacon with a cross; when the hill is well open of the woody point, it will lead to the southward of the shoal from Kundshoved, round which are rocks one cable off, and which is also marked by a beacon.

Hiarbæk fiord.—Anchor off Hiarbæk village one cable from the beach, in 8 to 9 feet water. In the southernmost part of the fiord, towards the mouth of Skals rivulet, there are 4 to 9 feet water, soft bottom.

Hiarbæk is connected with Viborg by a railway, of which place it is the port, and where the custom-house is.

LÖGSTÖR.—Vessels coming from Hiarbæk or Skive and bound to Lögstör must avoid Lemdrup Rön, a rocky patch, just covered at low water, to the north-west of Lemdrup hills, and 4 cables from the beach. With Ornhøj house open northward of the town of Lögstör, a vessel will pass to the westward of it.

The bar, which extends 2 miles to the westward of Lögstör, and separates the sound inside of Lögstör from the bredning, is, on account of its shallow water (only 3 to 5 feet), a great impediment to navigation between the western part of Liim fiord and the town of Aalborg. The bottom consists of loose sand, and consequently the channel is subject to frequent changes, particularly with westerly gales, rendering the services of a pilot indispensable.

There are 15 to 21 feet water in Lögstör, but the inlet is only one cable wide, and the banks on either side steep-to.

The impediment of the bar has been met by digging the Frederic VII. canal, having in it a depth of 8 to 9 feet with a basin at each end with the same depth. The canal begins near and to the west of the town of Lögstör, follows the flat seashore, and ends near to the south of Lemdrup Rön. A *fixed red* light is shown from the north mole head.

In the port there are 6 to 7 feet water, and along the north side of the town there are quays and several places for boats. The best anchorage is mid-channel, with a hawser fast to the shore to prevent the anchor getting foul. A ferry puts Lögstör in communication with Føerge islands and Aggersborg. At 2 miles eastward of Lögstör there is another ferry across Agger sound, where there is a quay for a steam-boat, and 7 feet water.

The current at times runs 2 to 3 knots; during continued gales from the eastward it runs to the westward, and during westerly winds in a contrary direction. The water level at Lögstör depends on the wind; during a continuance of settled weather, a regular ebb and flood is perceptible, though the rise of the water is very small, and the current does not change its direction.

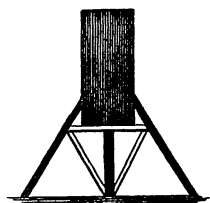
Agger sound.—The course through the narrow sound to the eastward of Lögstör takes an easterly direction. The banks or flats along either side are steep to as far as Agger sound farm; and at $1\frac{1}{2}$ miles eastward the channel is marked by beacons. The track is to the southward of the Middle ground and through the Hage deep, which is rendered narrow by a sand-bank, named Storkhals, that extends from the south side, and the Normandshage, a shoal barely covered on the north side, to the southward of Trelleholm.

Nibe bredning is to the eastward of an extensive flat with some islands on it. The depth is from 7 to 12 feet, the deepest water being on the eastern side. Vessels having passed through the Draget should steer about S.S.W. $\frac{3}{4}$ W., until Giöl church comes on with the western house, which has a red roof and is situated near the houses of the Klitgaard, then steer through a small channel with 6 to 8 feet water and anchor opposite the mole of Nibe. A pilot resides at Nibe.

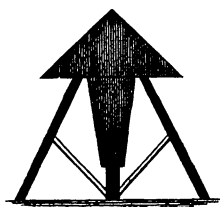
Aalborg is connected with the Kattegat by the Lanoge Rak, a channel about 15 miles in length, which opens into the Kattegat at Hals by the Haa Dyb. It has a large trade in corn, but the harbour has filled up considerably, so that vessels drawing 10 feet water are obliged to be lightened before entering it.

The COAST.—Resuming the description of the coast from Thybo Rön (the estuary of Liim fiord) to Hanstholm, the direction is about N.E. for a distance of 27 miles, and consists chiefly of large sand-downs. The land behind the sand-downs is, however, hilly, and amongst the most remarkable objects are, the Tornbakke, a conical hill, near the beach, and the Galgebjerg, which, though distant 7 miles from the beach, where the low ridge lies, show as eight different hummocks when abreast of them, some distance to the southward of Stenbjerg, with a beacon on the sand-down. Another hill, Blokkenbjerg, near the beach, $6\frac{1}{2}$ miles northward of Thybo Rön, is of moderate height, but steep towards the beach, and may serve as a good guide when standing in for Thybo Rön; the large mansion of Vestervig may also serve the same purpose.

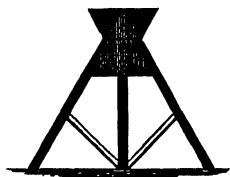
Beacons from 40 to 45 feet high, and painted *red*, have been erected as landmarks on the summits of the downs close to the coast at the following places :—



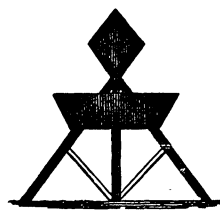
Agger.



Stenbjerg.



Tvorup.



Klitmøller.

Lifeboat.—There is a lifeboat and rocket apparatus stationed at Vester Agger, 5 miles north of Thybo Røn.

LODBJERG LIGHT.—At Lodbjerg, $6\frac{1}{2}$ miles northward of Thybo Røn, there is a *white* light showing a *double flash every twenty seconds* in the following order :—Two successive flashes of *three seconds* duration each, divided by an eclipse of *three seconds* and followed by an eclipse of *eleven seconds*; the light is elevated 159 feet above the sea, and should be visible in clear weather from a distance of 18 miles.

The lighthouse, 115 feet high, is constructed of granite.

Klitmøller.—Two fishing lights are exhibited at Klitmøller, northward of Örhave, about $5\frac{1}{2}$ miles south-westward of Hanstholm.

The lights are *fixed red* lights, visible in clear weather from a distance of about 3 or 4 miles. These lights are exhibited from 15th March to 15th November.

HANSTHOLM appears like several hummocks or islands. The remarkable objects on Hanstholm are the church, without any turret; the lighthouse, 53 feet high, and 80 yards from the church; and some farmhouses, named Hedegaarde, in an elevated situation, and equidistant from each other. The extreme north point of

Hansthalm is called Roshage, and about $1\frac{1}{2}$ miles south-eastward of it is Hiertebjerg, 205 feet high. The bottom is rocky for some distance round Hansthalm.

LIGHT.—On Hansthalm is an octagonal *white* tower 74 feet high, which exhibits at the height of 215 feet above high water, a *group flashing electric* light, showing *three flashes* in quick succession *every ten seconds*, visible in clear weather from a distance of 20 miles.

Fog signal.—The fog signal is three blasts in quick succession every minute.

They will be given alternately from two powerful sirens erected on the edge of the high land ; one of which is situated about 600 yards N.W. from the lighthouse, the other about 1,700 yards N.E. from the lighthouse. The first-named siren will transmit sound strongest in a westerly direction, the other strongest in a northerly direction.

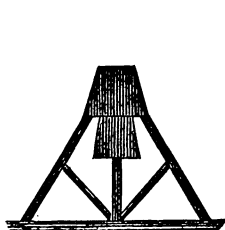
A signal station is established in connection with the telegraph station at Hansthalm ; the station is 320 feet N.N.W. from the lighthouse.

Messages will be received and delivered from sunrise to sunset. The signals used are those of the International code ; vessels showing their numbers will have their names telegraphed (*gratis*) to the Exchange at Copenhagen at noon. Messages are sent in the Danish language and letters.

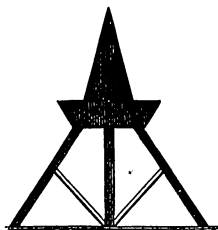
Lifeboat.—Hansthalm is a lifeboat and rocket apparatus station.

BULBJERG BLUFF (Lidstrand).—The coast from Hansthalm, which is rocky, trends eastward for nearly 14 miles to Bulbjerg, forming Vigsö bay, which affords anchorage in a convenient depth ; at one mile off shore there are 4 fathoms. This bluff promontory is about 360 feet high ; it is excavated by the sea, and a part of it, the Skareklit, which is worn away from the cliff, is about 60 feet high, and lies 80 yards outside of the point. South-west of Bulbjerg stands Bierget mill on a hill, and surrounded by several houses ; and behind is the remarkable high land of Kaase Knude, steep on its west side, and containing some villages and Hiardemaal church, with its high steeple.

Beacons from 40 to 45 feet high, and painted *red*, have been erected on the summits of the downs close to the coast at Vigsö and Bulbjerg.



Vigsö.



Bulbjerg.

Bragerne shoals lie N.W. from Bulbjerg, more than one mile from the shore, with from 3 to 5 feet on their shoalest parts, and inside of them a narrow and crooked channel with a depth of 4 to 5 fathoms. Vessels should not stand nearer the shore than 4 miles, or into less than 10 fathoms.

A *black* buoy is moored northward of the north-western 6-feet patch.

JAMMER BAY.—From Bulbjerg the shore continues to the eastward and northward for about 43 miles to Hirtshals point, forming Jammer bay.

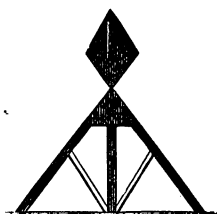
Beacons from 40 to 45 feet high, and painted *red*, are placed on the summits of the downs close to the coast at the following places:—



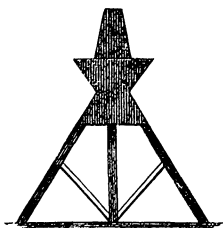
Svinkløv.



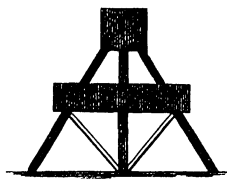
Blokhús.



Kjetterup cliff.



Lökken.



Rubjerg Knude.

Rödgrund and Bakken banks.—From 10 to 13 miles westward of Hirtshals point are two shoal patches: the Rödgrund, $1\frac{1}{2}$ miles in extent, with a depth of $3\frac{1}{2}$ fathoms, over rocky bottom, lies 3 miles from the shore, with the conspicuous church of Venneberg bearing S.E. $\frac{1}{4}$ E.; the Bakken, with 4 fathoms on its shoalest part, lies with the same church S.E. by E. $\frac{1}{2}$ E., distant $4\frac{1}{2}$ miles from the shore.

Lifeboats.—There are six lifeboat stations with rocket apparatus:—In Jammer bay; at Thorup strand, 9 miles eastward of Bulbjerg; at Slettestrand, 6 miles more to the eastward; at Blokhus, half-way between Bulbjerg and Hirtshals point; at Lökken, 16 miles S.W. of Hirtshals point; at Lönstrup, 9 miles from the point; and at Hirtshals point.

HIRTSHALS POINT.—Off Hirtshals point a flat extends about 6 miles, with several shallow spots on it, though none with less than 4 fathoms, and the innermost is only one mile from the point. A prudent distance for a large vessel to pass this point is about 10 miles.*

Besides the lighthouse and signal station the other remarkable objects on the shore near Hirtshals are: Løibjerg a hill of moderate height, flat on its upper part, on which stands Horne church and mill; and the high land of Rubjerg, consisting of sand-hills, distant 10 miles south-westward of the point. It is rendered the more distinguishable by Venneberg church, to the westward of which is a small round hillock. To the southward of Rubjerg stands the large mansion of the Börghum Kloster estate, with the church contiguous. Amongst the sand-downs on the shore, the Svinklöv is one of the most remarkable, being high, steep, and flat on the top, on which there is a beacon. *See page 254.*

LIGHT.—On Hirtshals point is a circular tower, 11 feet in height, constructed of red clinkers, but from a distance it appears of a grayish colour, from which is exhibited at an elevation of 187 feet above high water a *fixed white* light, varied by a *white flash* of about *six seconds* duration *every two minutes*; it is visible in clear weather from a distance of 20 miles, between the bearings E.N.E. through south and west to W.N.W. On the north-west side of the structure a surface 18 feet square is painted *white*.

Fog signal.—A siren, situated 40 yards north-west of the lighthouse, gives *two* blasts in quick succession *every two minutes*.

* *See Admiralty chart*;—The Skagerrak or Sleeve, No. 2,289; scale, $m = 0.25$ of an inch.

Ice signals.—Signals are made from the lighthouse and from a mast with a yard, situated 66 yards westward of the lighthouse, similar to those at the Skaw (*see* page 258).

A signal station in connection with the telegraph station is erected at 50 yards N.E. of the lighthouse, where messages are received and dispatched from sunrise to sunset. The signals are made by the International code. Vessels which show their distinguishing signal on passing will be reported at noon at the Exchange in Copenhagen without charge.

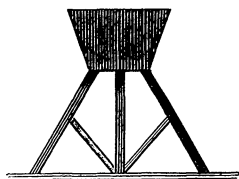
Messages ought to be given, and are sent in the Danish language and letters.

A telegraph cable connects Hirtshals point with Arendal in Norway, and Newbiggin on the north-east coast of England.

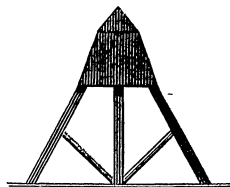
TANNIS BAY.—Between Hirtshals point and the Skaw is Tannis bay, where good shelter will be found with south-east and southerly winds.

A vessel may anchor on Skag or Skaw bank, a sandy bank 5 or 6 miles from the shore, in 9 or 10 fathoms; inside this bank the water is deeper. Abreast Gammel Skagen (Old Skaw) there are 10 or 12 fathoms at $1\frac{1}{2}$ miles from the shore over sandy bottom; a little further east the shore is steep-to.

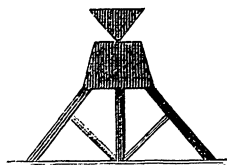
Beacons from 40 to 45 feet high, and painted *red*, are erected as landmarks on the summits of the downs close to the coast at the undernamed places :—



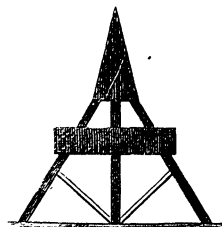
Tversted.



Kandestederne.



Spirbakken.



Gammel Skagen (Old Skaw).

Lifeboats.—There are lifeboats and rocket station at Hirtshals point, in Tannis bay, and at the Skaw.

Tides.—It is high water, full and change, at Hirtshals point at 4h. 28m. and at the Skaw at 5h. 56m., but the rise and fall is scarcely one foot.

HÖIEN LIGHT is a *group flashing white* light, showing *four flashes every thirty seconds*; each flash being of *two seconds* duration, the eclipses between the flashes of *three seconds*, and between the groups of flashes of *thirteen seconds* duration, respectively. It is visible from N. 71° E., through south, to S. 89° W., elevated 46 feet above the sea, and should be seen 12 miles in clear weather.

The lighthouse, 45 feet in height, is a *white* octagonal tower, with a *white* building at its base. Eastward of the lighthouse is a red chimney, 55 feet high; and south-westward of it a brown screen, about 40 feet high.

The fog-signal consists of two sirens; one provided with a parabolic reflector painted white, and situated on a sandhill northward of the lighthouse; the other on a sandhill W. by S. $\frac{1}{2}$ S. about nine-tenths of a mile from the lighthouse; which in thick or foggy weather will be sounded alternately so as to give *four blasts every minute*.

The western siren sounds loudest in a westerly direction, the eastern one sounds over the whole fairway.

Buoy.—An automatic whistle buoy, painted *red* and marked *Höien*, is moored westward of the Skaw in 13 fathoms, with the beacon at Old Skagen bearing S.E. by E. $\frac{1}{4}$ E., distant about $1\frac{3}{4}$ miles.

A *red* conical buoy replaces this buoy when ice renders it necessary.

THE SKAW or SKAGEN.—The north point of Jutland, at the junction of the North sea with the Baltic, is the turning point of one of the principal routes of commerce. Near the point stands Skagen village.

Those passing the Skaw can communicate with the signal station, just eastward of the lighthouse, by the International code.

Telegraph cable.—A submarine cable is laid from the Skaw to Marstrand island in Sweden. Two beacons have been erected to mark the position of the shore end, and the direction of the cable.

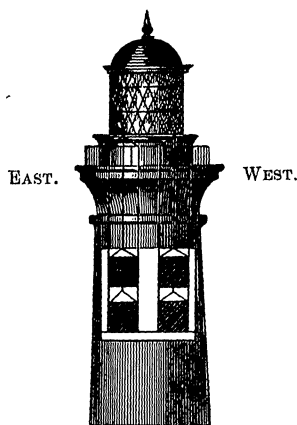
LIGHT.—The light-tower on the Skaw stands 1,700 yards E. by N., from the old lighthouse, is circular, built of *red* brick, and 152 feet in height; it exhibits, at 144 feet above high water, a *fixed white* light, illuminating with its greatest brilliancy, between the bearings E. by N. through south to N.E. by N. A fainter light is shown over the land and through the remaining points of the compass. In clear weather, the principal light is visible 18 miles; and the faint light 12 miles.

LIGHT-VESSEL.—The Skaw reef light-vessel, *red* with *white* cross, two masts, Danish flag over globe on fore-mast; with *Skagens Rev* on sides, lies in 20 fathoms at the end of the reef, $3\frac{1}{2}$ miles E. by N. $\frac{3}{4}$ N. from Skaw lighthouse, and exhibits a *flashing red* light *every half minute*, visible in clear weather 10 miles.

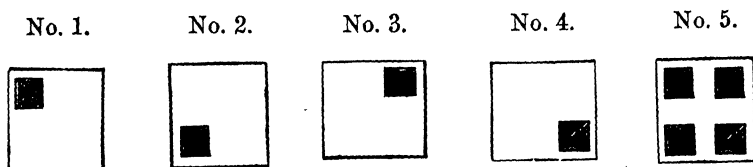
Fog signal.—A siren gives *one* blast every *two minutes*.

Signal apparatus on Skaw and Hirtshals lighthouses.

ICE-SIGNALS.—When the state of the ice at the stations of Vinga Skærgaard, Elsinore, Sæby, and of Frederikshavn is such as to impede the navigation at those stations, the following signals will be shown, by means of black tables, hung out beneath the gallery on the white painted surface on the northern side of the new lighthouse of Skaw:—



Skaw lighthouse, seen from the North; and Hirtshals lighthouse seen from the North-west.



No. 1. Ice in Vinga Skærgaard preventing navigation.

No. 2. Ice at Elsinore prevents entering the harbour.

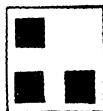
No. 3. Ice at Frederikshavn prevents entering the harbour.

No. 4. Ice in Læsø channel preventing navigation.

No. 5. Ice in Vinga Skærgaard, at Elsinore, at Frederikshavn, and in Læsø channel.

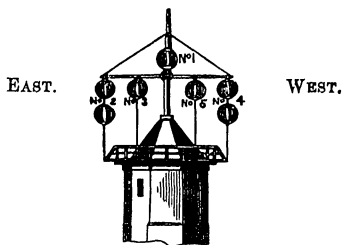
By varying the black tables shown, the places corresponding to them will be indicated; for example,—

means, ice in Vinga Skærgaard, at Elsinore, and in Læsø channel.



SIGNALS.—To indicate that one or more of the light-vessels in the Kattegat, either from the state of the ice, or from some other reason have left their stations, the following signals will be shown during the time the vessel is away from her station :—

By day.—On a mast, with a yard attached and raised on the top of the old lighthouse of Skaw which stands nearly one mile W. by S. from the new lighthouse.



The signals at the old lighthouse of Skaw and Hirtshals flag-staff, seen from the North.

1. A ball on the mast above the yard, *Trindelen* light-vessel is not in station.
2. Two balls at the eastern yard arm, when the *Kobberground* light-vessel is not in station.
3. A ball at the quarter of the eastern yard, *Knoben* light-vessel is not in station.
4. Two balls at the western yard arm, when the *Læsø* channel light-vessel is not in station.
5. A ball at the quarter of the western yard, when *Skagen* light-vessel is not in station. Shown only from Hirtshals.

By night from an auxiliary light station on the northern side of the new lighthouse of Skaw, and 62 feet above the level of the sea, there will be exhibited :—

1. A *red* light when the *Læsø* channel light-vessel is not in station.
2. A *green* light when the *Trindelen* light-vessel is not in station.
3. A *white* light when the *Læsø* channel light-vessel and the *Trindelen* light-vessel are not in their stations.

The *white* auxiliary light should be seen in clear weather about 9 miles, and the coloured lights about 5 miles, in a northerly direction, and decreasing on both sides to about 60°.

NOTE.—In order to form a correct knowledge of the state of the ice in the Kattegat, the ball signals ought always to be compared with the table signals. When therefore the signals from the old lighthouse of Skaw indicate that the light-vessels have left their stations, it may be expected to meet ice whether the tables are shown or not.

When the auxiliary light shows a *white* or a *green* light, and consequently indicates thereby, that in both cases the *Trindelen* light-vessel has left her station, there will be a probability that the light-vessel of *Kobberground* has also been removed, the general rule being that this light-vessel is taken away earlier than the former. In this case the *Anholt-Knoben* light-vessel will probably have been removed from her station, and the auxiliary light on the lighthouse of *Anholt* will then be shown.

Further information concerning the state of the ice and of the light-vessels in the Kattegat may be obtained by exchanging signals with the station at Hirtshals or the Skaw.

For ice in the Great Belt and in Aarhus bay a white flag with a blue vertical stripe will be hoisted on the flag-staff of Fornes lighthouse ; and for ice in the northern part of the entrance to the Great Belt and in the fairway west of Hielm island, a similar flag on the flag-staff at Hielm lighthouse.

Weather signals.—Signals in connection with the telegraph station on the Skaw, are made at the mast-head by means of a black cone and cylinder, and remain hoisted for 36 hours after the receipt of the despatch from the Meteorological Institution at Christiania ; they signalise great atmospheric disturbances that may threaten the neighbouring coasts in the North sea, and the Baltic.

A cylinder over a cone with the point down.—A gale threatened from the south.

A cylinder under a cone with the point up.—A gale threatened from the north.

A cylinder alone.—A gale, without indicating the direction.

The greater part of the gales in these seas commence from the south and generally veer to the west, but seldom attain great strength until the wind veers to the north-west or north.

PILOTS.—From the Skaw, pilots are to be obtained who are all able to bring ships to an anchor, or to conduct them to Hirtsholms or to Fladstrand road. Likewise a pilot boat from Frederikshavn cruises about there, in order to furnish ships with pilots for Helsingör (Elsinore), Nyborg, and Fredericia, and a Swedish pilot-boat to supply pilots for the Skærgaard and the coast of Sweden, as well as for Arendal in Norway.

SKAW SPIT.—The narrow neck of land between the lighthouse and the extreme point is named the Grenen, and consists of compact hard sand. From the point a spit extends 2 miles E.N.E. ; it consists of a hard white sand, with stones thrown there occasionally from ships in ballast. From the extreme point of the spit, its eastern side takes a south-westerly direction until abreast the lighthouse, towards which it then trends, until it merges in the shoal water that extends about 3 to 3½ cables from the shore. The spit, on which there is a surf in stormy weather, forms a curve to the south-eastward, and does not appear to change in its direction or extent.

On the south side of the spit the depth gradually increases, so that the soundings are a good guide ; whereas on the north side it is steep-to, and ought not to be approached within the depth of

12 fathoms, which suddenly shoals to 4 fathoms. During the day the edge of the spit is distinguished from aloft by the colour of the sand, which shows through the water.*

Skaw spit light-vessel when in position is an excellent guide for vessels rounding the Skaw. *See* page 257.

Beacon and buoy.—A large *red* conical buoy carrying a *red* pole with a *red* ball is placed at the end of the spit, in $4\frac{1}{2}$ fathoms, with the old lighthouse and the old church tower in one; but there can be no certain reliance upon its remaining in position. This buoy should be passed, in a large ship, at a distance of $1\frac{1}{2}$ to 2 miles.

A beacon with two brooms is placed at the south-east extremity of the reef, in 4 fathoms, the old lighthouse bearing W.N.W., and the old tower West. This beacon and buoy remain in their places until carried away by the ice, when others are as soon as possible substituted for them.

Anchorage.—With west and south-west winds, temporary shelter will be found south-east of the Skaw, with the old lighthouse bearing about N. by W. in 8 or 9 fathoms, sandy bottom. Or more to the southward, Aalbek bay is also a convenient place for a temporary anchorage.

Current and ice.—The direction of the current on the south-eastern side of the Skaw is commonly W.S.W. with northerly and westerly winds, and E.N.E. with southerly and easterly winds. In gales of any of these winds it may attain a velocity of 4 knots, whereas with moderate weather it seldom runs faster than one knot. In easterly gales the ice is piled up on that part of the spit where there is less than one fathom water, and sometimes remains for a long time after the rest of the ice is gone.

* Directions for Kattegat, Belts, &c. will be found in the "Danish Pilot."

INDEX.

	Page		Page
Aa river	54, 61	Back sand	221
Aade brunnen	195	Bakken banks	255
Aalboek mill	247	Balg, the	156
Aalborg	250, 251	Ball beacon, Elbe	202
Aardappelen gat	126	Ballum church	229
Aargab beacon	241	—— village	166
Accumer Ee buoy	177	Baltrum island	176
Agger	242	Banc à la Ligne	51
—— beacon	252	Banjaard banks	116, 117
—— sound	251	Barling sand	229
Aggersborg	250	Barlt haven	213
Akkepolle gat	167	Barriere	51
Akkumer Ee buoy	177	Beens hallig	224
Albodal Ellenbogen beacon	226	Belgian uniform buoyage	16
Albue head, lights	227	Belum church	202
—— point	228	Bergen-op-Zoom	119
Alkmaar	158	Berghaven	138
Alster river	207	Bergues bank, buoy... ..	44
Alte Jap shoals	224	Beveland	89
—— Liebe, semaphore	206	Beverwijk tower	141
—— Mellum sand	179	Bieningen entrance... ..	126
—— Weser	185, 191	Bierget mill	253
Altenbruch, light	201	Binnen Vlake	134
Ameland gat, buoys, beacons	167	Biornsholm bay	249
—— island, lights	166	Bjergegaard	241
——, tides	169	Bjergehuse beacon	241
Amrum bank... ..	224	Blaabjerg	239
—— harbour	223	Blaavand point, beacon, light	238
——, light	222	Blanc Nez cape	50
——, tides	223	Blankenberghe, dock, lights	88
—— island	221	—— flats	96
—— light	222	Blauort sand, beacon, tides	213
Amstel river	147	Blexen church	190, 191
Amsterdam, commerce, docks	147	Bligh bank	40
——, coals, longitude, re- pairs, time signal... ..	148	Blinde Rön	247
—— North Sea Ship canal	146	Blokenbjerg	252
ice	146	Blokhuis beacon	254
Anchorage, Elbe to Horn reefs	213	Bodum church, mill	245
Antwerp, time signal, trade	108	Bokke gat	126, 132
——, coal, docks, repairs, sup- plies	109	Bollen, the	129
——, tides	91	—— sand-hills	142
Appelzak	97	Boompjes	137
Audinghen tower	58	Bordelum	221
Aussen Jade light-vessel	181	Börghum Kloster	255
		Borkum flat, light-vessel	170
		——, directions	171
		—— island, lights, reef	169
		——, beacons, signals	170

	Page		Page
Borkum island, tides	173	Browershaven gat, lights	121
Bornriff, buoy	167	—————, navigable	
Borsele point, light	105	—————, depths 120, 123	
Bosch, light, pilots	202	—————, pilots	119
—————, plaat, beacon	168	—————, tides	122
Bosche, the	162	—————, road, anchorage 120, 126	
—————, beacons	167	—————, town	120
Boschsand beacon	213	Brown ridge	149
—————, flat	209	Bruges steeples	88
Botkil bank	98	Bruinse road	124
Boundary, Belgium and Nether-		Brunsbüttel light	202
lands	89	Brunshausen storm signals .. 199	
—————, Bremerhaven ... 189, 190		Buiksloot	158
—————, France and Belgium ... 76		Bulbjerg bluff	253
—————, Germany and Denmark 231		—————, beacon	254
—————, Netherlands and Ger-		Bull beacon	194
many	169	Buoyage, uniform system; Belgian	16
Bourbourg canal	68	—————; Danish 20	
Bovbjerg light	242	—————; French 16	
Bövling church	243	—————; German 18	
Braderup	229	—————; Nether-	
Bradser point	245	lands 17	
Braeck bank	49	Burgsluis	119
Bragerne shoals	254	Büsum haven, light	214
Brake, coal, docks	193	—————, tides	213
Brandaris tower, light	164	Butter sand	230
Bredning (Broad)	244	Buxer point	248
Bree zand	117	Bygholms Veile	247
Breedt bank	47		
Breewijd, the... ..	157		
Breiholz reach	219		
Bremerhaven	191		
—————, boundaries ... 189, 190		Cachelot flat	174
—————, coal, docks, repairs,		Calais	55
statistics, timesignal 192		—————, harbour, coal... ..	60
—————, lights	189	—————, depth on bar	55
—————, tides	190	—————, directions	58-60
Bremen	193	—————, docks	55, 56
—————, navigable depths to ... 185		—————, lights, pilots, tugs 56	
—————, light-vessel	187	—————, tides and signals ... 57	
—————, tides	191	Callentsoog	141
Breskens	106	Campen, light	172
—————, lights	96	Camperdown... ..	141
Brielle gat	133	Cancer shoal... ..	236
—————, directions, tides ... 134		Carolinen siel	177
Brinkmahof forts, lights	188	Cassel town	65
British storm signals	5	Charlois	138
Broers bank	50	Clif d'Islande bank... ..	45
—————, duin	77	Coal, Brake	193
Bröns hill	227	—————, Bremerhaven	192
Brother's down	77	—————, Calais	60
Brouwer flat	174	—————, Cuxhaven	206
Browershaven gat	120	—————, Delfzijl	175
—————, directions	124	—————, Dordrecht	121
		—————, Dunkerque	72

	Page		Page
Coal, Hamberg	208	Domburger Rassen	98, 116
—, Harlingen	166	Dordrecht harbour	120
—, Hornum	223	—, coal	121
—, Husum... ..	221	Dortsman bank	118
—, Lister deep	223	Draaby vig	248
—, Nordenhaven	193	Draget inlet	231
—, Ostende	87	Droogte van Bruinse	123
—, Rotterdam	133	Dubbelduin	141
—, Toning	218	Duhnen	202
—, Wyk harbour	223	Dunen beacon	178
Cocksdoorp	161	Duinkaap	161
Coquelles windmill... ..	51	Dunkerque	68
Couple mont	50	—, coal, directions, pilots	72
Cunette sluice	69	—, depths at entrance ...	69
Current, North sea	11	—, docks, lights	70
Cuxhaven, coal, quarantine, sema-		—, tides and signals	71
phore	206	— banks	41
—, lights	201	— roads	67
—, navigable depths	197	—, tidal streams	68
—, storm signals	199	Dwars in Den Weg	123
—, tides	203	Dwarsgat	190
—, time signal	207	Dyck banks	44-46
		—, light-vessel	46
Dagebüll	221	East beacon, Elbe	202
—, light	222	— Breedt bank	48
Dam rak	147	— Dyck bank	45
Danger signals, French	22	—, light-vessel	46
Dangerous sunken wrecks... ..	15	Eastern Ems, caution	174
Danish storm signals	9	—, buoy, telegraph cable	174
— uniform buoyage	20	East Ems beacon	170
De Bol	117	— Frisian islands	175
— Honte channel	105	— gat, Ameland	167
— Horst, Vlieland	161	—, Schelde river	103
— Koog	149	—, directions,	
— Kooi	158	tides	104
Deep-soundings channel	36	— lights	94
Degen point	248	— Hinder bank	40
Delfzijl, buoys, navigable depths... ..	175	— pass, Dunkerque	66
—, lights	173	— Schelde	110
—, coal, supplies, tides	175	—, directions	118
Den Burg	149, 160	—, lights	111
Deurloo channel	101	—, tides	115
—, bar, tides	102	— Schouwen bank	112
—, buoys	98	— land beacon	170
—, directions	103	Easter sand	122
Dijkwater	123	Eastern channel, Nieuport road ...	80
Dirkoomsduin, light	150	Eggrland	160
Ditmarscher grund	214	Egmond aan zee, lights	141
Dogger bank	1	Eider canal	219
Dollert, the	171	— river	214, 218
Domburg church	104	—, caution, ice, lights,	
— light	94	navigable depths	215

	Page		Page
Eider river, beacons, buoys, pilots	217	Fienne windmill	43
———, directions, tides ...	218	Fischer balje, light	172
———, tidal signals	216	Flaauwe Werk, light	128
Eiderstedt	211	Flakstjerten sands	231
Eierland	160	Flemish banks	41
Eierslev hillock	247	Flushing	106
Elbe river, navigable depths ...	197	———, docks, repairs, time signal	107
———, buoys	202	———, harbours	106
———, caution, ice	198	———, lights	95
———, directions, torpedo		——— road	105
——— practice	204	———, tides	91
———, lights, pilots, storm		Føerge islands	250
——— signals	199	Fogs and fog signals	5
———, tides and streams ...	203	Föhr island	222
Elleboog bank	97	Föhrde	219
Ellenbogen, signal station ...	226	Föhrer Schulter	225
Emden, harbour	175	Fort Philippe village	61
———, storm signals	175	Fosse de Mardick	65
———, tides... ..	173	Fransche bank	153
Ems Jade canal	175	——— pass	97, 99
—— river, caution, navigable		Frederic VII. canal, light ...	250
——— depths... ..	171	French danger signals	22
———, buoys	174	——— storm signals	6
———, ice, lights, pilots ...	172	——— uniform buoyage	16
———, tides	173	——— weather signals	7
Engelsche Vaarwater	118	Friedrichstadt	215, 218
Engelschman gat	160	Friesche gat	168
Engelst point	248	Fulda river	184
Englishman's flat	168	Furnes canal	68
Ertbölle point	249	—— church	77
Esbjerg harbour	232	—— towers	48
———, lights	233	Futterup point	246
———, directions, tides ...	234	Fuur islands, sound	248
Esens church... ..	176	Fymoord	138
Eskiar, wood	249		
Everingen pass	90		
Eversand, lights, signals ...	188		
Ezels bank	152		
		Gales	4
		Galge plaat	118
		Galgebjerg	251
		Galgenput	102, 103
Færker point	248	Gallge reef	231
Fairy bank	37	Gammel Skagen, beacon ...	256
Falga light	150	Gardes rocks	52
Falsche tief	209	Geeste river	191, 192
Fanö beacons	231	Geestemünde	192
——, tides	232	———, lights, beacon ...	189
—— Lo	232, 235	Geldzak flat	174
Fayne deep	248	Geller point, buoy	244
Fedderwarder	185, 188	General navigation, North sea	2
Fegge cliff, sound	246	Genius bank, light-vessel ...	182
—— Ron, lights	247	German storm signals	7, 9
Fialtring	242	——— uniform buoyage ...	18

	Page		Page
Ghent, ship canals to ...	108	Hals	251
Ghyvelde church	77	Hamburg	207
Giol church	251	—, coal, docks, hospital	208, 209
Gluckstadt, storm signals ...	199	—, communications, com-	
—, tides	203	—, pass correction, docks	209
Glyngör harbour, point ...	248	—, tides	203
Goedereede harbour lights ...	128	—, time signal, trade ...	208
Goeree gat, island	126	Hamburger hallig	224
—, directions	131	Han næs	247
—, lights	128	Handbjerg	245
—, navigable depths	126	Hanseatic cities	193
—, pilots	129	Hansthalm	252
—, tides and streams	130	—, light, signals	253
Gorishoek	119	Harboöre	242
Graa deep	232	Harle pass, buoy	177
—, beacons, buoys, direc-		Harlingen, coal	166
—, tions, tides and streams	234	—, lights	164
—, caution, depth on bar,		—, navigable depths ...	165
lights, pilots	233	—, tides	166
Grande Synthe	65	Harlingerland	176
Gravelines, depth on the bar ...	61	Haring Vliet	130
—, directions, tug	64	Harre Vig	247
—, lights, pilots, tides ...	63	Harseens fort	156
—, tidal harbour, dock ...	62	Hattstedt church	220
—, point	65	Haurvig beacon	241
Gravenhage	139	Haut Fond de Gravelines buoy ...	47
Great Cassel	65	Hedegaarde	252
Great North Holland canal ...	158	Helder	157
Grevelingen channel	123	—, light	161
Gris Nez cape, light, tides ...	51	Hellevoetsluis	126
Grisetaa point	245	—, dock time signal ...	127
Gröde island	224	—, light	128
Groden beacon	202	—, tides	130
Groede church	88	—, road	132
Groningen	168	Heligoland	193
Groninger wad	168	—, anchorage, directions,	
Grönning hage	249	—, tides	196
Groote Kaap	141	—, buoys, Lloyd's signal	
Grossedown	224	—, station	195
Grosser Vogelsand	205	—, beacons, lights ...	194, 195
Gulderup, anchorage	246	Helligsö	244
		Helsdeur road	158
		—, tides	153
		Heppens, lifeboat	180
		Hester point	247
		Het Zand	96
Haa Dyb	251	Heuvel sand-down	149
Haaks banks	151	Hever river, beacons, depth on bar	219
—, light-vessel	149	—, buoys, directions, tides	220
Haamstede light	121	—, pilots	211
Haarlem church	141	Heyst bank, road	97
Habell island	224	—, light	88
Haff sand	228	Hiarbæk fiord, village ...	250
Hage deep	251	Hiardemaal	253
Hague, the	139		

	Page		Page
Hiertebjerg	253	Husum river, road	221
Hils bank	49	Huttes d'Oye... ..	60
Hinder bank, Goeree	129	Hvalp sound... ..	249
— banks, North sea	38-40	Hygum church	245
Hirtshals point, light	255		
—, ice signals	256, 258		
—, tides	257		
Hjerting	232		
—, channel	235		
Hog steen	195		
Hohe brunnen	195	Ice, buoyage	11
— Weg flat	185	—, Eider river	215
— light	187	—, Ems river	172
—, tides	190	—, Jade river	180
Höien, buoy, light; fog signal	257	—, New Rotterdam canal... ..	135
Hollum village	166	—, North Sea Ship canal	146
— light... ..	167	—, Schelde river	89
Holm Tunge, hage	246	—, Texel	155
Holmsland	240	—, Weser river	185
Holt knobs	226	—, Ymuiden... ..	146
Hompels bank	97	— signals, Jade river	177, 182
Hompelvoet	123	—, Wangeroog	177
Hondon plaat	129	—, Weser river	178
Hondsbossche Zeewering	141	Indre Knuden	231
Hoofdplaat	100	Inner Katwijk	140
Hooge hallig	224	— Ratel bank	46
Hook of Holland, canal	135	— Ruytingen bank	44
— Schouwen	121		
— siel light	182		
Hoorn, Terschelling	162		
— village	149		
Hoornsche Hoofden	129		
Horn reefs, directions	236	Jade river	179
—, buoys, lights	237	—, anchorage, directions,	
—, tides	239	tides	183
Horne church, mill	255	—, buoys, caution, ice,	
Horned heads	129	navigable depths,	
Hornum beacons	226	pilots... ..	180
— deep	225	—, lights	181
—, harbour	225	—, Wilhelmshaven... ..	180, 183
—, coals	223	— flat	179
— sands	226	Jammer bay	254
Horsborn sand	173	Jan Paulus, light	128
Horumersiel, lifeboat	180	Jegindö	245
Höyer deep lights	230	Jegindtap spit, beacon	245
Huibert flat	173	Jelse point	249
— gat	171, 173	Jørne	234, 236
Huisduinen	142	Jordsands flat	230
Hulst	108	Juist island	176
Hunnigen sand	230	— reef	174
Husby klit beacon	241	Junge Jap	221
— church	243	Jungnamen sands	226
Husum harbour, tides	220	Jutland bank	1
—, coal	221	Juvrer deep, sands	231

	Page		Page
Kaapduinen	104	Laeggen	232
— lights	94	L'Aisne	89
Kaaphuisje	104	Lamb shoal	228
Kaas bredning, wood	247	Land deep	221
— head	245	Lang Lutjen	190
Kaase knude	253	Lange dike	122
Kabbelaars plaat	122	Langedoen	133
Kabeljauws plaat	123	Langeroog, beacons	177
Kadzand island	88	Lanoge Rak	251
Kaiser harbour	189	Launs bredning	249
Kaloo bank	98	Lauwer zee	168
Kaloot bank	105	Le Nolle plaat	99
Kampen village	227	— Rouge riden	52
Kampveere	111	— Vlieger	123
Kandesterne beacon	256	Leeuwarden	166
Kating siel	218	Leffrinckoucke church	77
Katterup	244	Leghörn sand	230
Katwijk, binnen, light	140	Lehe tower	190
Keitum village	219	Lemdrup Rön	250
Key buoys, Weser river	187, 189	Lemvig, light	244, 245
Kilsand	231	Lenghenaar breakwater	99
Kjetterup cliff, beacon	254	Leopold canal	88
Kjædgaarde beacon	241	Les Gardes rocks	52
Klegod beacon	241	— Quenocs, buoy	52
Kleine kaap	141	Leuquenaert tower	71
Klitgaard	251	L'Heugena tower	71
Klitmöller beacon, lights	252	Lidstrand	253
Klotzen loch	210	Liim fiord, navigable depths	243
Kniep haven, sand	225	—, pilots, tides	244
Knock bank, road	97	Liin sand	225
Knocke, light	88, 173	Lille Olesbjerg	241
Knude deep	232	Lilho sand, buoy	235
Knuds head	248	Lisseweghe steeple	91
Knudshörn shoal	224	List beacon	226
Kolynsplaet	119	— road	229
Konig Christians Koog	214	Lister deep, tides	228
Koog	161	—, bar, buoys, caution,	
Koopvaardersshutsluis	158	directions	229
Koper sand	174	—, coal	223
Kore sand	231	—, lights	227
Krabbesholm	249	— ley	230
Kueerens bank	99, 116	Little Cassel	65
Kuipersbult	168	Liv Tap spit	249
Kugel point, light	201	Livö, bredning	248
Kundshoved	250	Lloyd's signal station, Heligoland	195
Krimslot, lights	137	Lodbjerg, light	252
Kykduin light	150	Lögstör	250
Kykuitdyk	124	— bar, bredning	247
		Löibjerg	255
		Lökken beacon	254
		Lombartzyde church	77
Laan ridge	152	Long Forties sandbank	1
La Barriere	51	Longstrup	255
— Panne, light	80	Loosduinen tower	139

	Page		Page
Loreley bank	195	Næs sound	245
Loubjerg point	245	Nathurn reef, buoy	195
Lunde hage	249	Navigation, general; North sea ...	2
Lutje waard flat	156	Naze of Norway	34
Lys river	89	Neeltje Jans	116
		Nes village	166
		Netherlands uniform buoyage ...	17
		— weather signals	7
Maager point... ..	246	Neuwerk island, lights	201
Maas bank, flats	133	—, storm signals	199
— light-vessel	136	New beacon	170
— river, pilots	119	— Hever ström	219
Maassluis	134	— Rotterdam canal	134
Maassluische gat	134	—, buoys	137
Madenburg harbour, wharf ...	208	—, directions... ..	138
Manö flat	231	—, ice, navigable	
Mano island	227	— depths, tidal signals	135
Mardick bank	65	Nibe, bredning, pilot	251
— tower	46	Nieuulay windmill	51
Mariakerke	78	Nieuport, depths, directions ...	81
Mars diep	155	—, lights, tides and signals ...	82
Meeuwer staart	174	—, pilots	83
Meldorf haven	214	— bank	78
Melk Horn	177	— road	79
Mellum beacon	179	—, directions, lights	79
Memmert isle, beacon	174	Nieuwe diep, coal, dock, time signal	157
Merewede river	137	—, lights	151
Meuse river	119	—, tides	153
Meyers Legde, beacon	189	— gat	134
—, light, signals	183	— Maas	137
Middel bank	114	— Neuzen, lights	107
— ground, beacons	248	— Sluis, lights	95
— rug	152	—, beacon	96
Middle Dyck bank	45	— Waterweg	134
— gat, Ameland	167	— West gat, Texel	157
—, East Schelde	117	— zand	117
— Hever... ..	219	Nieuweneuzenpolder	107
Middleburg, canal, haven ...	96	Nieuwepolder light	107
Middleharnis harbour	130	Nissum, bredning, point	244, 245
Middlekerke bank, tower ...	78	— fiord	243
Midsland	162	Nolle plaat	99
Miele river	214	Noorder gronden, buoys	164
Mill beacon, Fanö	232	Noordland bank	116
Minden	171	Noord oost gat, Vlie stroom ...	165
Minsener old Oog beacon ...	179	— Steen bank	114
— sand, light-vessel	181	Noorder gat, Goeree	126, 132
Molen gat	151	Noords Vaarder beacons	162
Monster tower	139	Noordwijk binnen	140
Morsö	246	— aan zee, light	140
Morsum village	229	Noord-west gat, Vlie stroom ...	165
Münden	184	— gronden, buoys	164
Munk patch	237	Nordby, lights	234
Munkmarsch harbour	230	Nordenhaven	192
— light	227	—, coal	193

	Page		Page
Norder Aue	223	Oosterburen village...	168
— Elbe	209	Oosterhoofd, light ...	111
— gründe	191	Oosterende	177
— Piep	213	Ooster zand	122
Norderney gat, buoy ...	176	Oostkapelle	110
— island, light, storm sig-		Or point, light	247
— nals, beacon	176	Orange mill	101
Norderoog	223	Ording church	220
Nordmarsch island ...	224	Örhage	252
Nordstrand island ...	219	Örhale point	246
Nörngaard	250	Ornhoi house	250
Norman deep	236	Orteil bank	45
Normandshage	251	Öslös church	249
Nörre Nissum church ...	245	Ostende	84
North Arup	248	—, depths, docks, lights, tidal	
— Banjaard bank	117	— signals	85
— beacon, Elbe	202	—, directions, coal, repairs,	
— channel, Nieuport road ...	80	— tides	87
— Haaks	152	—, pilots	86
— Hinder bank, buoy, fog-sig-		— bank	78
— nal, light-vessel ...	38	— Inner road, directions ...	84
—, tidal streams ...	39	— Outer road, directions ...	83
— Holland canal	158	—, caution	84
— sea, current	11	Ossenhoek light	122
—, general description ...	1	Oste reef, light-vessel ...	202
—, navigation	2	Otterndorf, lights	202
—, ice	11	Otzumer balje, buoy ...	177
—, routes	32	Oude Maas	120
—, tides and tidal streams ...	12	— Schild	159
—, winds and weather ...	2	— Steen bank	92
—, wrecks	15	— West gat	157
— ship canal, Amsterdam ...	146	Oudelek	119
—, coal, ice, pilots ...	146	Outer banks, North sea ...	37
—, depths	143	— Ratel bank	46
— and Baltic canal	207	— Ruytingen bank	42
— east channel, Nieuport road ...	80	—, buoys, light	43
— west channel	52	Ourting bank	41
Ny mill	247	Outlying banks, North sea...	36
Nykiobing, lights	247	Overflakkee island	126
Nyminde gab	241	Overgaard	246
—, tides	239, 242	Oye village	60
—, land	241		
Odde sound	245	Paardemarkt bank	97
Old Hever ström	219	Paarden plaat	123
— Schmal deep	224	Pakhus point, light... ..	234
— Skaw	256	Pampus bar	147
Oldenburg	179	Pander deep	230
Onrust flat	117	Peck brunnen	195
— shoal, beacon	151, 153	Peelriff	232
Oost Dunkerque, light ...	80	Pellworm	219
		Peter Meyer's sand, beacons ...	231, 232

	Page		Page
Petite Synthe	65	Roshage	253
Petten polder	142	Rothe Kliff	226
—— village	141	——, light, sand	227
Pietersduin	149	Rother sand	184
Pilsam, light	172	——, light	185
Pinke gat	167	Rotholmene	249
Plaat gat	168	Rotterdam	137
Pollen, the	164	——, coal, docks, repairs, tugs, time signal	138
Pulse vig, anchorage	248	Rottum island, beacons	169
Purmerend	158	——, tides	173
Purren ström	217	Rouge riden, le	52
		Routes, North sea	32-35
Quenocs, les ; buoy	52	Rozenburg	134
		Rubjerg Knude beacon	254
		Rug van Baarland	90
		—— Bath	90
		—— den Ooster	125
Raan bank	97	Rüst sand	228
Rabs shoal	111	Rütergat	221
Rade de Calais	53	Ruytingen banks	42-44
Rammekens road	105		
Randsel bank, light	172	Sables tower	49
—— gat	171	Saddledown	224
Rassen bank	98	Sæbesholm	246
Rastedt	179	Sædenstrand, lights	233
Ratel banks	46	Salgierhøi	246
Raversyde	84	Salines, the	51
Reisby shallow	231	Salling sound	247
Rendsburg	214, 218	Salt sand	228
Renesse lights	121	Salzhorn, light	188
Rescue stations	26-31	Sandettié bank	41
Rhine river, light	140	Sandinsel, beacons	195
Ribben, the	129	Sands tower	49
Ribe	231	Sandspierling point... ..	229
—— channel	232	Sandy island, beacons	195
Riden de Calais	53	Sangatte village	50
Ridens de la Rade, buoys	53	Schaar, the	117
Riff gat	171, 173	—— of Renesse	125
—— beacon	170	Schar ridge	112
Riisgaard bredning	249	Schardinggeul passage	99, 105
Rindby lights	234	Scharhörn beacon	202
Ringebjerg beacon	238	Scheelhoek bank	130
Ringkiöbing fiord	242	Schelde river... ..	89
Ringkjöbing deep	237	——, directions for ap- proaching... ..	90
Rinkelaars	151	——, ice, pilots	89
Robben flat	190	——, lights	93
Rödgrund	255	——, navigable depths	90
Röm island	228	——, tides in entrance	91
Römer deep	230	Scheveningen	139
—— flat	231		
Rön islet	247		
Rönnen shoal	244		
Roompot, the	116		
——, directions	118		

	Page		Page
Scheveningen light	140	Skaw or Skagen, pilots, weather	
Schiermonnikoog, lights	168	signals	260
, tides	169	— spit	261
Schilbols nol, lights	151	—, anchorage, current, ice,	
Schillighorn lights	181	light	261
—, ice and storm sig-		Skive fiord, village	249
nals	182	Slenk gat	157
Schlaf mole	182	Slettestrand	255
Schleswig Holstein canal	219	Slikken van Flakkee	123
Schlüssel buoys	187, 189	Sloe, the	104
Schmal deep	221	Slugen or Gullet	236
—, anchorages	223	Sluis gat, town	89
—, b u o y s, directions,		Sluissche gat	100
lights	222	Slyk gat	126, 131
—, coal, tides	223	— plaat	130
Schobüll church	220	Smal bank	48
Schooneveld anchorage	91	Snouw bank	48
bank	97	—, light-vessel	49
Schoorl downs	141	Sögaard light	245
Schouten Kaap	142	Sönderho, beacons	231
Schouwen bank	112	Sören Bovbjerg knob, buoys	237
—, light-vessel	113	South Banjaard bank	116
—, tidal streams	113	— channel, Heligoland	195
— island	110	— Haaks	152
—, light	121	Spangereid	34
Schuiten sand	174	Spaniard duin	87
— gat, bell beacon	155	Spiekeroog	177
Schulau light-vessel	198, 203	Spirbakken	256
Schulpen gat... ..	155	Spleet channel	101
—, caution	157	Springer deep	123
—, depths in	149	Spyker plaat	105
—, directions	156	St. Peter's beacon	217
—, tidal streams	153	— Pierre les Calais... ..	43
—, torpedoes	156	Steen banks, buoys	114
Schweinsrücken	224	— beacon, Voorne island	133
Seal plaat	129	— deep, directions	115
Seesand, beacon	221	— point	223
Selle brunnen reef, buoy	195	Stellendam, light	128
Shell gat	155	Stenbjerg	251
Signals, danger ; French	22	— beacon	252
—, distress	25	Storkhals	251
—, pilotage	25	Storm signals, British	5
Signal stations	26-31	—, Danish	9
Sillerslev point	247	—, French	6
Skag bank	256	—, German	7, 9
Skallingen	232	—, Netherlands	7
—, beacons... ..	234	Stortemelk	165
Skals rivulet... ..	250	Strand beacon	179
Skaregaard	247	Strandby, telegraph cable	235
Skareklit	253	Stroom bank	78
Skarre point	246	—, buoy	79
Skaw bank	256	Struer anchorage	245
— or Skagen, buoy	257	Stuifdijk, light	151
—, ice signals, lights 258-260		Suder Aue, anchorage ..	224

	Page		Page
Süder Piep, beacons, directions,		Tidal signals, Netherlands	22
tides... ..	213	— streams, Brielle gat ...	134
Süderoog beacon	219	—, Brouwershaven gat	122
— hallig	224	—, Calais	57
Sundsøre hage, beacon ...	249	—, Dunkerque road ...	68
Sunken wrecks	15	—, East Schelde	115
Svinklöv beacon	254	—, Elbe	203
S.W. gat, Texel	157	—, Elbe to Horn reefs	212
Sylt island	225	—, Goeree gat	130
—, beacons... ..	226	—, Graa deep	234
—, lights, tides	227	—, Horn reefs	239
Systems of buoyage... ..	16-20	—, Maas to Texel	148
		—, North Hinder	39
		—, North sea	15
		—, Ostende	87
		—, Schelde entrance ...	91
		—, Schouwen bank	113
		—, Terschelling bank ...	163
		—, Texel	153
		—, Vlie Stroom... ..	166
		—, Ymuiden	145
Tannis bay	256	Tides, Ameland	169
Tating church	218	—, Amrum harbour	223
Tegeler flats	184	—, Antwerp	91
Telegraph cables	31	—, Blaavand point	239
— stations	26-31	—, Blankenberghe	91
Templers tower	81	—, Blauort sand... ..	213
Ter Heyde	139	—, Borkum	173
Termonde	90	—, Emden	173
Termunterzijl light... ..	173	—, Bremen	191
Terneuse harbour	107	— light-vessel... ..	190
— lights	107	—, Bremerhaven	190
Terschelling bank, light-vessel	162	—, Brielle gat	134
—, tidal streams	163	—, Brouwershaven	122
— island	162	—, Busum	213
—, lights	164	—, Calais	57
Têtes, the	53	—, Cuxhaven	203
Texel, the, navigable depths, lights	149	—, Delfzijl	175
—, directions	154	—, Dunkerque	71
—, ice	155	—, Eider river entrance	218
—, pilots, tugs	151	—, Elbe entrance	203
—, stroom	159	—, Esbjerg	234
—, tides and streams	153	—, Flushing	91
—, Willemsoord	149	—, Glückstadt	203
— island, caution	160	—, Goeree gat	130
—, light	161	—, Graa deep	234
Thisted, breeding, harbour ...	246	—, Gris Nez cape	51
—, lights, pilots	246	—, Harlingen	166
Tholen island	119	—, Heligoland	196
Thomas Smit gat	166	—, Hellevoetsluis	130
Thornton ridge, gas buoy	41	—, Hirtshals point	257
Thors Minde	243	—, Hohe Weg lighthouse	190
Thorup	255	—, Horn reefs	239
Thybo Rön	243	—, Husum	220
—, beacon	241, 244		
—, buoy, caution, ice, light-			
vessel, navigable depths	243		
—, pilots, tides	244		
Tidal signals, French	21		

	Page
Tides, Liim fiord	244
—, Lister deep	228
—, Nieuport	82, 83
—, North sea	13
—, Nyminde Gab	239, 242
—, Ostende	87
—, Pellworm	220
—, Rotterdam	134
—, Rottum	173
—, Schiermonnikoog	169
—, Texel	153
—, Tonning	218
—, Veere gat	116
—, Wangeroog	183
—, Weser river entrance	190
—, West Terschelling	166
—, Wilhelmshaven	183
—, Wyk harbour	223
—, Ymuiden	145
—, Zierikee	116
Tise church	249
Tonning harbour, coal, tides	218
—, light	217
Topsand	235
Tornbakke	251
Trapegeer bank	50
Trelleholm	251
Trend mill	249
Trouie	51
Tusch gründe	221
Tversted beacon	256
Tvorup beacon	252
Uithuizer wad	173
Ulv spit	237
Val light	111
Varde rivulet... ..	232
Varel	182
Vareler siel, lights	182
Vedsted	231
Veere	96
— gat	110
—, tides	116
— lights	111
Veermans plaat	123
Vegesack, dock	193
Venneberg church	255

	Page
Venö bay, island, sound	245
Verklikker, Brouwershaven	121, 125
Vester Agger... ..	252
Vestervig	252
Viborg... ..	250
Vigsö bay	253
— beacon... ..	254
Vil point, shoal	248
— sound	246
Vinkel hage, light	245
Visby bredning	246
Visschersbalg	172
Vlie stroom, navigable depths,	
— pilots	165
—, tidal streams	166
Vlieger, the	123
Vlieland, lights	161
—, lifeboats, telegraph	161
Vlissingen (Flushing)	106
Vøedersö beacon	241
Vogelsand	205
Volkenburg	140
Vollewiek, lights	217
Vondelingen plaat	118
Voorne canal... ..	127
— lights	128
— island	126
Vortrapp deep	224
—, buoys, caution, direc-	
— tions	225
Vuilbaard bank	118
Vyl shoal, buoy, light-vessel	237
Wagonpad swatchway	152
Walcheren island	96
— road, directions	115
Walde light, windmills	60
Walvisch staart	97
Wangeroog, ice signals	177
—, beacons, light	178
—, storm signals	178
—, telegraph cable	177
—, tides	183
Wandelaar bank	97
— light-vessel	93
Warwerort haven	214
Wasceels Rabs shoal	111
Wassenaar	140
Westende church	78
Watt fairway	188

	Page		Page
Wattringues plain	54	Willemsluizen	158
Watts, definition of	212	Willemsoord	149
Watum, light	172	————— docks	157
Weather signals, French	7	Willemstadt	120
—————, Netherlands	7	Winds and weather	2
Wenduyne bank, buoy	79	Winter buoyage	11
Werra river	184	Wissant village	50
Weser light-vessel, pilots	179	Witt Kliff	195
———— river	184	Witte lid light	162
—————, anchorages, beacons,		Wittetons rug	152
buoys	189	Wöhrden haven	214
—————, caution, ice, navigable		Wolf spit	237
depths	185	Woolpacks	110
—————, directions	191	Wrecks	15
—————, gun and torpedo prac-		Wremen channel	189
tice, tides	190	Wulpenburg	111
—————, lights, pilots	186	Wulsdorf tower	189
Wesselburen church	218	Wurster channel	188, 190
West deep, Nieuport road	79	Wynbol	117
—— Dyck bank	45	Wyk harbour, coal, tides	223
—— gat, Ameland	167	—————, lights	222
———, East Schelde	117, 119		
——— Hinder bank, light-vessel	39	Y arm... ..	147
——— pass, Dunkerque	66	Yder Knude	231
——— plaat	129	Ymuiden, buoys	142
——— Sluge	236	—————, coal, ice, pilots	146
——— Terschelling	162	—————, directions, navigable	
—————, lights	164	depths	143
—————, tides	166	—————, lights	144
—— Vedsted... ..	231	—————, tides and signals, tugs	145
Westen village	149	Yser river	81
Wester gronden, buoys	164	Yzeren beacon, light	128
Westerende	177		
Westerland, Sylt island	230		
Western Ems, caution	173		
—————, buoys, anchorage	174		
Westkapelle	96		
——— light	94		
White hill	224		
Whitebuoy ridge	152		
Wielingen channel, tides	99		
—————, buoys	97	Zaalduin	101
—————, directions	100	Zand kreek	119
—————, light-vessel	93	Zand-detié bank	41
Wierhoofd light	151	Zanddijk, lights	150
Wijk aan zee	141	Zandvoort, light	140
Wilhelmshaven, docks	183	Zeeburg	133
—————, coal, gun and tor-		Zeehonden plaat	117
pedo practice,		Zeeland	96
storm signals,		Zierikzee church, light	111
time ball	184	——— road	118
—————, lights	182	—————, tides	116
—————, naval station	183	Zijperschuitsluis	158
—————, tides	183	Zoutelande bank	98

			Page				Page
Zoutelande light	...	...	94	Zuider Pampus	...	...	126
Zuid Steen bank	114	— zee	159
Zuid wal	182	Zuydocote church	77
Zuider deep	130	— pass	66
— gat	90	— tower	49

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